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Pelagic Fur Seal Investigations, 1964

By Clifford H. Fiscus and Hiroshi Kajimura

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Pelagic Fur Seal Investigations, 1964

By

CLIFFORD H. FISCUS and HIROSHI KAJIMURA

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Frontispiece.--The M/V Harmony chartered by the Bureau of Commercial Fisheries for pelagic fur seal research in 1964.

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Pelagic Fur Seal Investigation, 1964

By

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ABSTRACT

The seventh year of pelagic research on the fur seal (Callorhinus ursinus), under the terms of the Interim Convention on Conservation of North Pacific Fur Seals was carried out off California, Oregon, and Washington from 7 April to 1 June, and in the Bering Sea from 4 July to 8 September 1964. Seals collected off California totaled 305; off Oregon, 10; off Washington, 28; and in the Bering Sea, 533. Fewer seals were seen off California in April and May 1964 than during similar research in January to March in 1958, 1959, and 1961; young females formed a larger proportion of the collections in 1964 (21-30 percent) than in previous years (10, 9, and 15 percent); 76 percent of the total males taken in all 4 years off California were collected in 1964. Summer distribution of seals in the Bering Sea was similar to that in 1962 and 1963. Females, predominantly mature, made up 91 percent of the Bering Sea collections. The percentage of tagged seals in pelagic samples increased progressively from 0.9 in 1958 to 4.9 in 1964. A seal tagged by the U.S.S.R. and recovered by a U.S. vessel was collected on 28 August about 60 miles northeast of St. Paul Island. The pregnancy rate (76.4 percent) was lower than in previous years because samples were taken off California during a period when a higher proportion of nulliparous and nonpregnant females were present. Gooseneck barnacles (Lepas sp.) and algae (Ectocarpus sp.) growing on the guard hairs of seals were more common in the spring of 1964 than in winter collections of other years. Thirty-three food species were identified in 876 stomachs in 1964. Merluccius productus was the major food off California, Oregon, and Washington. Squids, Clupea harengus pallasi, Theragra chalcogrammus, Bathylagidae, and Mallotus villosus were the leading foods in the Bering Sea.

INTRODUCTION

This report contains information on the seventh year of pelagic fur seal research by the United States under the Interim Convention on Conservation of North Pacific Fur Seals.

The first of two phases of the investigation in 1964 was on the distribution, abundance, migration, and feeding habits of fur seals off California, Oregon, and Washington in April and May; the second was on the occurrence and feeding of fur seals in Bering Sea in July, August, and early September. Reproductive condition of females was also studied.

Work off California was concluded by mid-April in previous years. The extension of observations to late May in 1964 provided additional information on late migration and movement.

In the Bering Sea, information was obtained on the area north from the Aleutian Islands to the Pribilof Islands, and on the feeding grounds to the east, north, and west of the Pribilof Islands.

METHODS, EQUIPMENT, AND ITINERARY

Vessels and equipment, and methods used in hunting and in the collection of data from seals killed, were described by Fiscus, Baines, and Wilke (1964). Briefly, seals were sighted from the vessel (or, during calm weather, from small boats accompanying it); shot with 12-gauge shotguns; and weighed, measured, examined, and skinned. Age was determined by counting annuli on longitudinal sections of

canine teeth. The weight and volume of the stomach contents were determined, and food items were identified and counted.

Records on seven female seals (six from California and one from Bering Sea) collected in 1964, for which data are incomplete, are included in the section on distribution of seals by date and locality, but are excluded from other sections of this report.

The chartered purse seine vessel, M/V Harmony,[1] began sealing off Cape Flattery, Wash., on 7 April 1964, sailed south to California waters, remained there until 28 May, and then sailed north to conclude the spring season off Cape Flattery 1 June. Observations and collections were made off Washington on 7-8 April, 31 May, and 1 June; off Oregon on 9-10 April, and 29-30 May; and off California on 11 April to 28 May. The Harmony left Seattle, Wash., 22 June for Unalaska Island, Alaska, where work in Bering Sea was started 4 July and concluded 8 September. The vessel returned to Seattle on 20 September.

Biologists aboard the Harmony were Clifford H. Fiscus and Hiroshi Kajimura, and during the spring field season, Gary A. Baines. Assistants on the vessel were George F. Rohrmann (spring) and Stanley B. Phillips and Richard K. Stroud (summer); Robert L. DeLong assisted in the analysis of data at the Bureau's Marine Mammal Laboratory in Seattle.

RESEARCH IN 1964

Distribution of Seals by Date and Locality

Washington, Oregon, and California.--Seals were seen during each of the 4 days spent off Washington. Forty-nine seals were seen in the vicinity of Umatilla Reef on 7 April (seals are usually found in this locality when present off Washington), and five were seen on 8 April. Only 13 seals were counted in the same waters on 31 May and 1 June, despite excellent weather.

Along the Oregon coast, 2 seals were seen on 9 April and 16 on 10 April; none were seen on 29 May and only 1 on 30 May. Weather conditions were poor for sealing on 9 April and 29 May.

Off California, the Harmony ran south to lat. 35°06' N., long. 129°49' W., about 50 miles west of Pt. San Luis. Known sealing grounds were searched from 11 to 15 April, but few seals were sighted. Ten were seen between Cape San Martin and Pt. San Luis on 14 April, in ideal weather. In 1959 and 1961, this area was part of the major wintering ground; large numbers were usually here during January, February, and March.

Dates of other observations and collections off California were (see fig. 1 for location of grounds): Farallon grounds--18-19, and 23-28 April and 1-2, 8, and 23-24 May; Eureka grounds--12, 15-17, 19, 25, and 27-28 May. Distribution on these grounds was restricted to a smaller area, and generally fewer seals were present in April and May than during January, February, and March in 1958, 1959, and 1961.[2] Many seals were still present, however, on the last day of observations in each area. On 8 May, 121 seals were seen on the Farallon grounds, and on 15 May, 128 seals were counted off Eureka. These were the two highest daily counts off California in 1964. The distribution of seals observed and collected is shown in figures 1 and 2.

Surface water temperatures varied from 9° to 13° C. off California, 10° to 13° C. off Oregon, and 9° to 12° C. off Washington.

Bering Sea.--To identify localities of observation and collection, the eastern Bering Sea was divided into six sectors centered between St. Paul and St. George Islands, as described by Fiscus, Baines, and Kajimura (1965). Each sector was subdivided into concentric zones, 30 nautical miles wide, that extended to the sector boundaries (fig. 3). Sectors are numbered from 1 to 6, and the zones from 1 to 10 (sector boundaries do not extend into zone 1, at the center of the area). The number of boat-hunting days, the total number of seals seen, and the total number of seals collected are shown in each zone.

On 4 July, the Harmony sailed west from Cape Cheerful, Unalaska Island, towards Seguam Island. When work north of Seguam Island was curtailed by weather, the vessel returned eastward. Only 47 seals were sighted during the 4-day trip. This number was low because of unfavorable weather west of Islands of Four Mountains, as well as scarcity of seals.

During the remainder of July, the vessel surveyed the known fur seal feeding grounds between Cape Cheerful and the Akun-Unimak Pass areas of Bering Sea, in sector 1, zone 7. The vessel sealed in this zone again on 7-8 September. Fur seals were fewer in this zone in 1964 than in 1962 (Fiscus, Baines, and Wilke, 1964) or 1963 (Fiscus, Baines, and Kajimura, 1965). In 1963, for example, 99.6 seals were sighted per boat-hunting day, as compared to 25.6 in 1964.

During August the Harmony surveyed distribution and feeding areas within a radius of about 70 miles of St. Paul Island. The distribution of seals near the Pribilof Islands, in zone 1, and zones 2 and 3 of all sectors, appeared to be comparable to that observed in

[1] M/V Harmony: registered length 70.5 feet, 61 net tons, 220 horsepower, cruising speed 9 knots (frontispiece).

[2] North Pacific Fur Seal Commission Report on Investigations from 1958 to 1961.

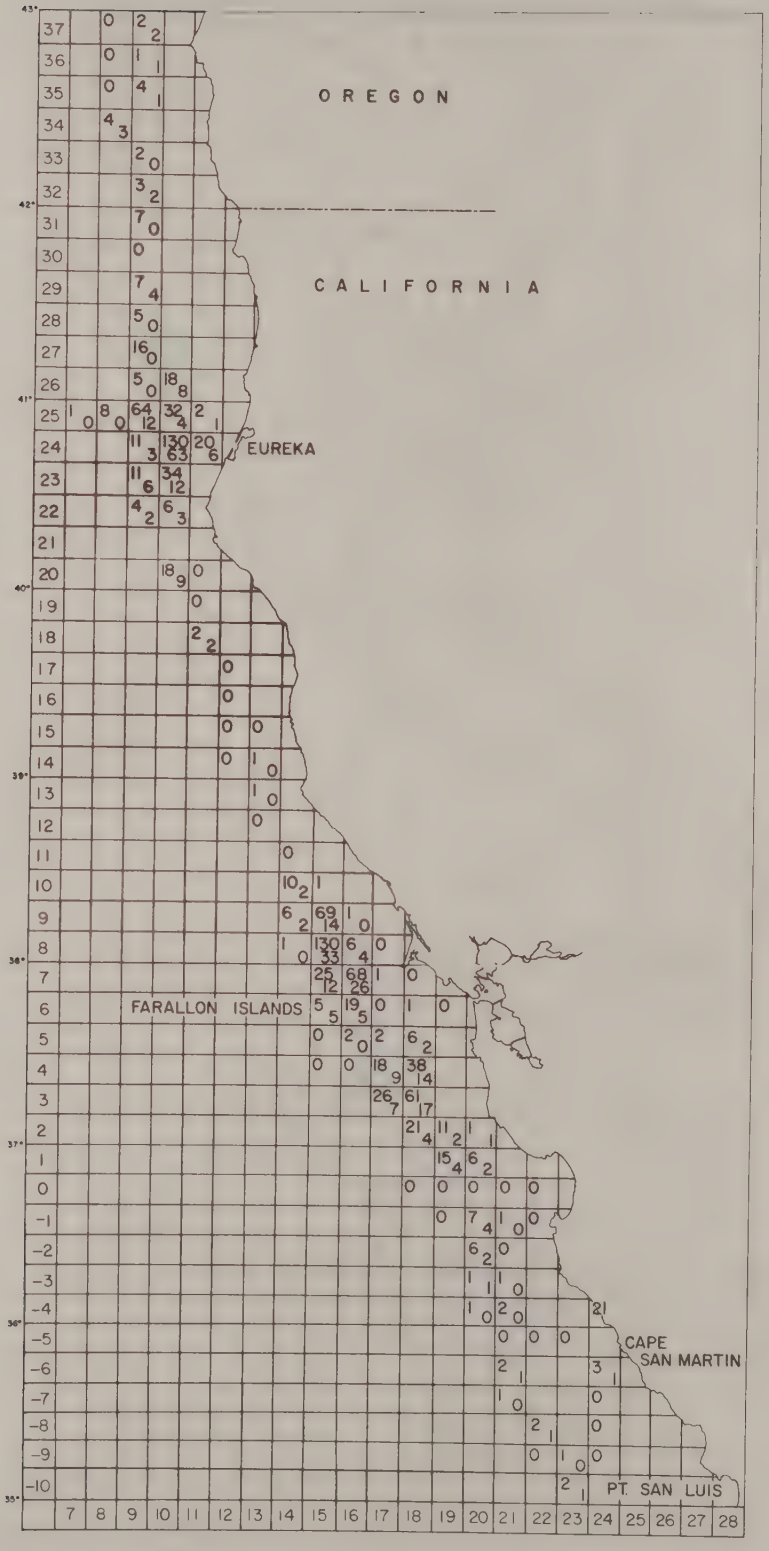

Figure 1.--Number of seals observed (upper figure in each square) and collected (lower) from lat. 35°N. to 43°N. in 1964. The sides of each square measure 10 nautical miles.

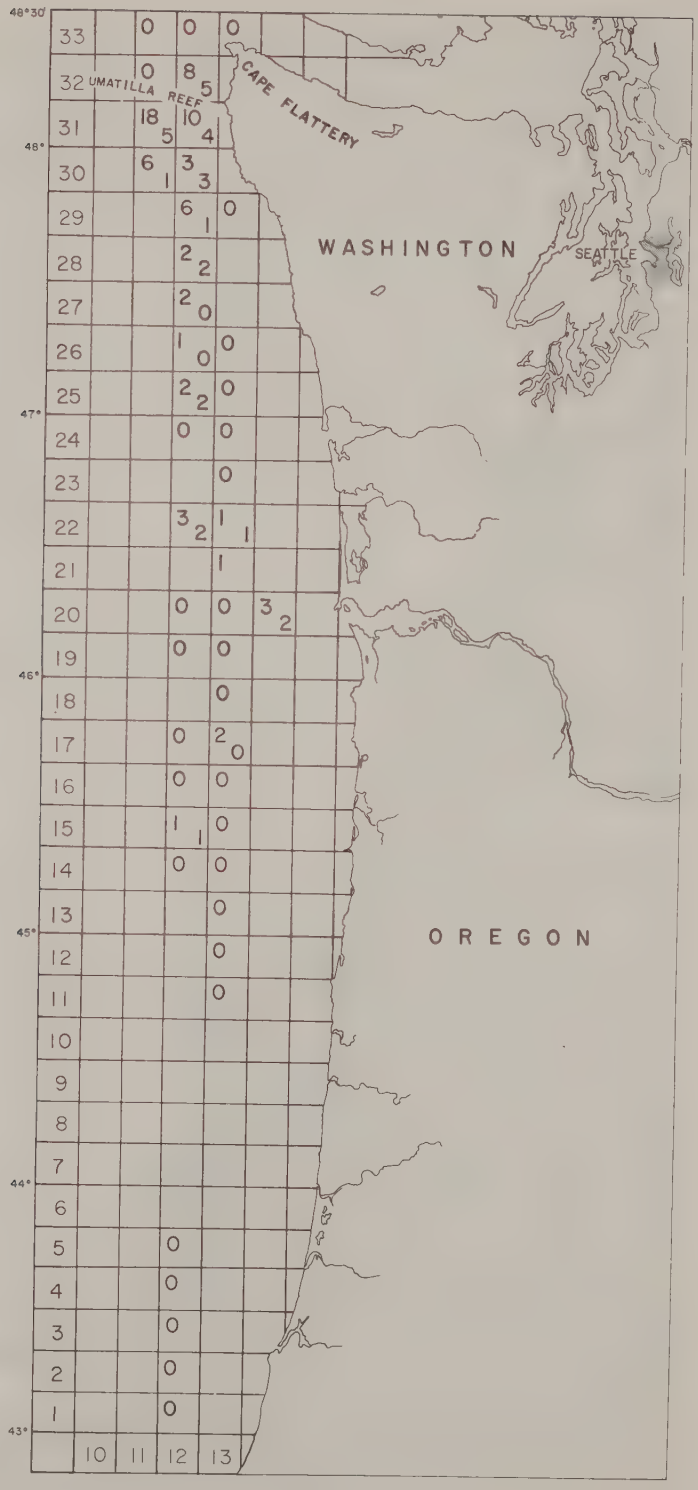

Figure 2.--Number of seals observed (upper figure in each square) and collected (lower) from lat. 43°N. to 48°30' N. in 1964. The sides of each square measure 10 nautical miles.

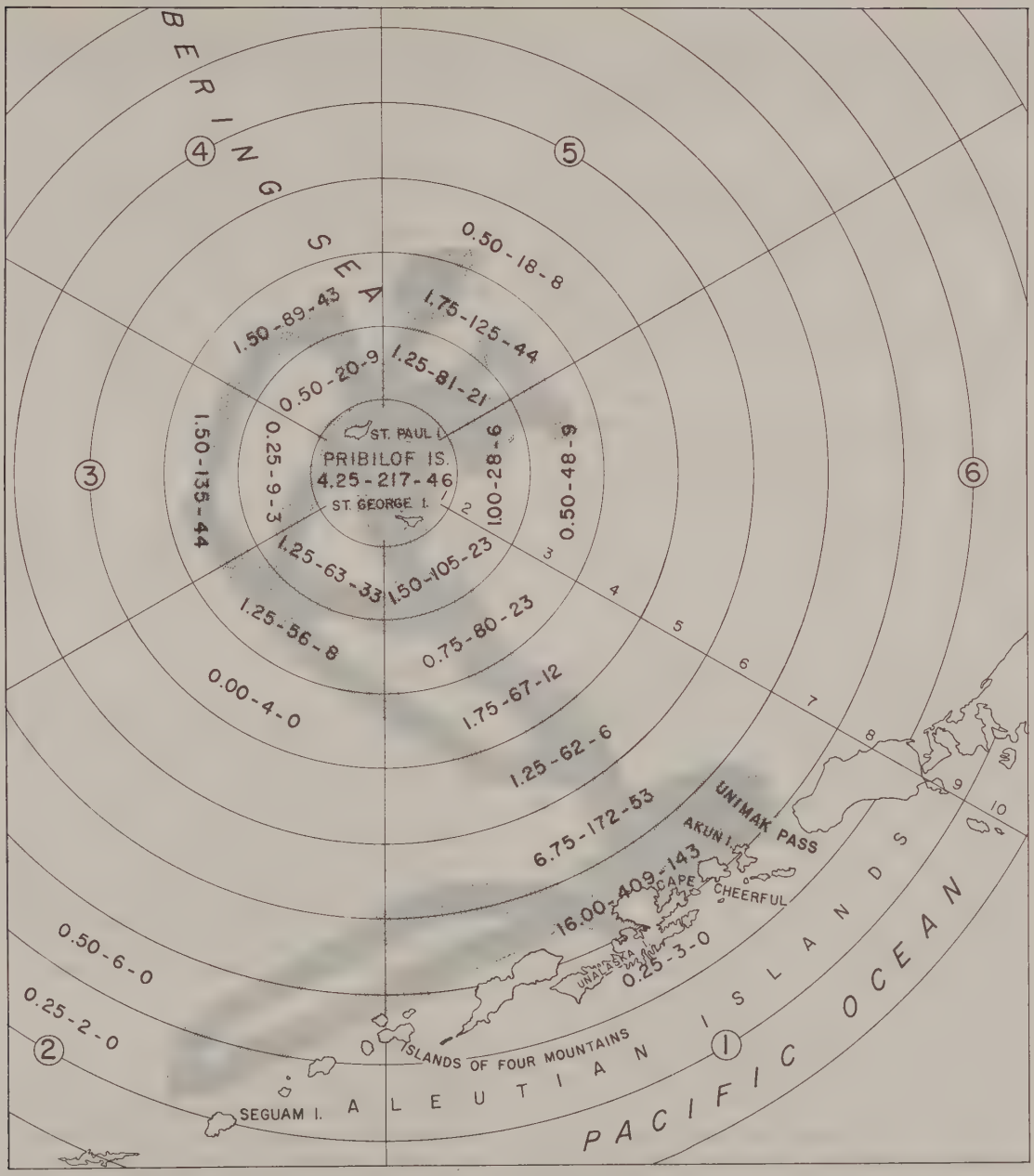

Figure 3.--Eastern Bering Sea: The operational area of the U.S. research vessel is shaded. The numbers in each zone represent, from left to right, number of boat days, seals seen, and seals collected from 4 July to 8 September 1964.

1963. Seals were feeding slightly closer to the Pribilof Islands than in 1963, however.

Surface water temperature in the Bering Sea ranged from 7° to 10° C. when the collections were made.

Relative abundance of seals, and size of groups.--The number and relative abundance of seals seen and collected, by 10-day periods, are shown in appendix tables 1 and 2. Fewer seals were seen and collected off California during April and May than in January to March of 1958, 1959, or 1961.[3] Numbers of seals seen and collected in the Bering Sea were comparable to 1962 (Fiscus, Baines, and Wilke, 1964) and 1963 (Fiscus, Baines, and Kajimura, 1965).

The number of seals per group was similar to that in previous years (appendix table 3). About 88 percent of the seals (96 percent in the Bering Sea, considered separately) were in groups of three or less. The largest group sighted off California contained 10 seals, and in the Bering Sea, 6.

Of the 2,864 seals sighted in 1964, 883 were collected; 97 were wounded and lost, and 68 were killed and lost.

Distribution by Age and Sex

The age and sex of seals collected in 1964, by month and area, are presented in table 1.

In the spring off California, 305 seals were collected. More males (20) were collected there in 1964 than in 1958, 1959, or 1961.[4] A 5-year-old male from the Farallon grounds was the oldest male collected to date off California.

Of 38 seals (5 males and 33 females) collected off Oregon and Washington, 66 percent were age 4 or younger.

Males form a small segment of the California fur seal population and appear later in the spring than the females (table 2). The females begin to arrive in December and by January are present in appreciable numbers. Young females (ages 1-4) are present from January through May but are relatively more abundant in April and May, when young seals are still moving southward or shoreward and mature females are migrating toward the breeding grounds.

In general, summer distribution of fur seals in Bering Sea was similar to that observed in previous years. Mature females appeared to be scarcer in sector 1, zone 7 in July than in other years, but were dominant in samples taken during 2 days in early September. Although samples were small, the age composition of young males was different than in 1963. In 1963, 30.7 percent of the males were 2 years old and 23.4 percent were 3 years old (Fiscus, Baines, and Kajimura, 1965); in 1964 the percentages were 23.4 and 44.8.

[3] See footnote 2, p. 2.

[4] See footnote 2, p. 2.

Pairing at Sea

Special efforts were made again in 1964 to collect male and female pairs in Bering Sea and to explore further the possibility that seals mate at sea. Four pairs, and the females from three other pairs, were collected.

Of the seven females, four were nulliparous (one with ovarian follicles less than 5 mm. in diameter, 6 years old; two with ovarian follicles more than 5 mm. in diameter, 5 and 7 years old; and one with ovarian follicle recently ruptured, 4 years old), and three were multiparous (two post partum, age 9 and 11; and one nonpregnant, age 11; a corpus luteum was forming in one ovary of each). Three of the males were 5 years old, and one was 9 years.

All males were mature enough to have active sperm in their testes (no samples of testicular tissue were saved for verification, however); only one of the females appeared to be in estrus. Mating at sea was not proved or disproved.

Tag Recoveries

Tag recoveries for 1964 are shown in table 3. The proportion of tagged seals in pelagic collections has increased progressively from 0.9 percent in 1958 to 4.9 percent in 1964. One 4-year-old female fur seal tagged on Bering Island by the U.S.S.R. was collected on 28 August 1964, about 60 miles northeast of St. Paul Island in the Bering Sea (lat. 57° 41' N., long. 168° 26' W.). This is the second Soviet-tagged seal collected by the United States off the American coast since the current pelagic research began in 1958 (the first was collected near Unimak Pass, Alaska, in 1962).

Size and Reproductive Condition

Size.--Lengths and weights are given for pregnant, post partum, and nonpregnant females collected in 1964 in appendix tables 4-9, and for males in appendix tables 10 and 11. The mean lengths and weights of male and female fetuses collected in 1964 are shown by 10-day periods in appendix tables 12 and 13.

Reproductive condition.--Reproductive condition of females collected in 1964 is shown in appendix tables 14-17, by area, age, and month. Nulliparous females formed about 40 percent of the catch of females in April and May off California.

The size and condition of graafian follicles in ovaries of females collected in July, August,

Table 1.--Age and sex by month and area of fur seals collected by the United States in 1964

Age	California				Oregon				Washington				Bering Sea				Total			
	Male		Female		Male		Female		Male		Female		Male		Female		Male		Female	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
April																				
1	2	28.6	1	1.0	-	-	-	-	1	100.0	6	33.3	-	-	-	-	3	30.0	7	5.9
2	1	14.3	6	6.4	1	50.0	2	28.5	-	-	1	5.6	-	-	-	-	2	20.0	9	7.6
3	4	57.1	6	6.4	1	50.0	1	14.3	-	-	2	11.1	-	-	-	-	5	50.0	9	7.6
4	-	-	12	12.8	-	-	2	28.6	-	-	-	-	-	-	-	-	-	-	14	11.7
5	-	-	13	13.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	10.9
6	-	-	4	4.3	-	-	-	-	-	-	5	27.6	-	-	-	-	-	-	9	7.6
7	-	-	8	8.5	-	-	1	14.3	-	-	-	-	-	-	-	-	-	-	9	7.6
8	-	-	4	4.3	-	-	-	-	-	-	1	5.6	-	-	-	-	-	-	5	4.2
9	-	-	1	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.8
10	-	-	3	3.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2.5
11	-	-	3	3.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2.5
12	-	-	6	6.4	-	-	1	14.3	-	-	1	5.6	-	-	-	-	-	-	8	6.7
13	-	-	2	2.1	-	-	-	-	-	-	1	5.6	-	-	-	-	-	-	3	2.5
14	-	-	5	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	4.2
15	-	-	7	7.4	-	-	-	-	-	-	1	5.6	-	-	-	-	-	-	8	6.7
16	-	-	4	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	3.4
17	-	-	3	3.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2.5
18	-	-	2	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1.7
20	-	-	4	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	3.4
Total	7		94		2		7		1		18						10		119	
May																				
1	3	23.1	8	4.2	-	-	-	-	-	-	1	20.0	-	-	-	-	3	23.1	9	4.6
2	4	30.8	14	7.3	-	-	-	-	-	-	1	20.0	-	-	-	-	4	30.8	15	7.6
3	5	38.4	21	11.1	-	-	-	-	-	-	1	20.0	-	-	-	-	5	38.4	22	11.1
4	-	-	14	7.3	-	-	-	-	-	-	1	20.0	-	-	-	-	-	-	15	7.6
5	1	7.7	18	9.4	-	-	-	-	-	-	-	-	-	-	-	-	1	7.7	18	9.1
6	-	-	12	6.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	6.1
7	-	-	9	4.7	-	-	1	100.0	-	-	-	-	-	-	-	-	-	-	10	5.1
8	-	-	6	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	3.0
9	-	-	5	2.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	2.5
10	-	-	13	6.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	6.6
11	-	-	10	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	5.1
12	-	-	13	6.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	6.6
13	-	-	4	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2.0
14	-	-	9	4.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	4.6
15	-	-	6	3.1	-	-	-	-	-	-	1	20.0	-	-	-	-	-	-	7	3.6
16	-	-	7	3.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	3.6
17	-	-	10	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	5.1
18	-	-	7	3.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	3.6
19	-	-	2	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1.0
20	-	-	2	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1.0
23	-	-	1	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.5
Total	13		191		-		1		-		5		-		-		13		197	
June																				
2	-	-	-	-	-	-	-	-	2	100.0	-	-	-	-	-	-	2	100.0	-	-
4	-	-	-	-	-	-	-	-	-	-	2	100.0	-	-	-	-	-	-	2	100.0
Total	-		-		-		-		2		2		-		-		2		2	
July																				
2	-	-	-	-	-	-	-	-	-	-	-	-	2	9.5	-	-	2	9.5	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	16	76.2	13	10.9	16	76.2	13	10.9
4	-	-	-	-	-	-	-	-	-	-	-	-	3	14.3	16	13.5	3	14.3	16	13.5
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	14.3	-	-	17	14.3
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	7.6	-	-	9	7.6
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	10.9	-	-	13	10.9
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	5.0	-	-	6	5.0
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1.7	-	-	2	1.7
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	6.7	-	-	8	6.7
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1.7	-	-	2	1.7
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1.7	-	-	2	1.7
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	6.7	-	-	8	6.7
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	6.7	-	-	8	6.7
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2.5	-	-	3	2.5
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1.7	-	-	2	1.7
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1.7	-	-	2	1.7
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	4.2	-	-	5	4.2
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1.7	-	-	2	1.7
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.8	-	-	1	0.8
Total	-		-		-		-		-		-		21		119		21		119	

Table 1.--Age and sex by month and area of fur seals collected by the United States in 1964--Continued

Age Years	California				Oregon				Washington				Bering Sea				Total			
	Male		Female		Male		Female		Male		Female		Male		Female		Male		Female	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
August																				
2	-	-	-	-	-	-	-	-	-	-	-	-	7	36.8	4	1.3	7	36.8	4	1.3
3	-	-	-	-	-	-	-	-	-	-	-	-	4	21.1	13	4.0	4	21.1	13	4.0
4	-	-	-	-	-	-	-	-	-	-	-	-	3	15.8	21	6.5	3	15.8	21	6.5
5	-	-	-	-	-	-	-	-	-	-	-	-	4	21.1	24	7.5	4	21.1	24	7.5
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	15.0	-	-	48	15.0
7	-	-	-	-	-	-	-	-	-	-	-	-	1	5.2	37	11.5	1	5.2	37	11.5
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	6.5	-	-	21	6.5
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	6.2	-	-	20	6.2
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23	7.2	-	-	23	7.2
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	5.9	-	-	19	5.9
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	7.8	-	-	25	7.8
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	4.4	-	-	14	4.4
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	4.0	-	-	13	4.0
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	5.9	-	-	19	5.9
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	2.2	-	-	7	2.2
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	1.3	-	-	4	1.3
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	1.6	-	-	5	1.6
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.6	-	-	2	0.6
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.6	-	-	2	0.6
Total	-		-		-		-		-		-		19		321		19		321	
September																				
Pup	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2.2	-	-	1	2.2
1	-	-	-	-	-	-	-	-	-	-	-	-	1	14.3	-	-	1	14.3	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	2	28.5	5	10.8	2	28.5	5	10.8
3	-	-	-	-	-	-	-	-	-	-	-	-	1	14.3	2	4.3	1	14.3	2	4.3
4	-	-	-	-	-	-	-	-	-	-	-	-	1	14.3	-	-	1	14.3	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2.2	-	-	1	2.2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4.3	-	-	2	4.3
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2.2	-	-	1	2.2
8	-	-	-	-	-	-	-	-	-	-	-	-	1	14.3	1	2.2	1	14.3	1	2.2
9	-	-	-	-	-	-	-	-	-	-	-	-	1	14.3	2	4.3	1	14.3	2	4.3
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4.3	-	-	2	4.3
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	17.4	-	-	8	17.4
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	6.6	-	-	3	6.6
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	8.7	-	-	4	8.7
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	6.6	-	-	3	6.6
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	8.7	-	-	4	8.7
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4.3	-	-	2	4.3
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4.3	-	-	2	4.3
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2.2	-	-	1	2.2
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2.2	-	-	1	2.2
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2.2	-	-	1	2.2
Total	-		-		-		-		-		-		7		46		7		46	
Combined totals																				
Pup	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.2	-	-	1	0.1
1	5	25.0	9	3.2	-	-	-	-	1	33.0	7	28.0	1	2.1	-	-	7	9.7	16	2.0
2	5	25.0	20	7.0	1	50.0	2	25.0	2	67.0	2	8.0	11	23.4	9	1.9	19	26.4	33	4.1
3	9	45.0	27	9.5	1	50.0	1	12.5	-	-	3	12.0	21	44.8	28	5.8	31	43.1	59	7.3
4	-	-	26	9.1	-	-	2	25.0	-	-	3	12.0	7	14.9	37	7.6	7	9.7	68	8.5
5	1	5.0	31	10.9	-	-	-	-	-	-	-	-	4	8.5	42	8.6	5	6.9	73	9.1
6	-	-	16	5.6	-	-	-	-	-	-	5	20.0	-	-	59	12.2	-	-	80	10.0
7	-	-	17	6.0	-	-	2	25.0	-	-	-	-	1	2.1	51	10.5	1	1.4	70	8.7
8	-	-	10	3.5	-	-	-	-	-	-	1	4.0	1	2.1	28	5.8	1	1.4	39	4.9
9	-	-	6	2.1	-	-	-	-	-	-	-	-	1	2.1	24	4.9	1	1.4	30	3.7
10	-	-	16	5.6	-	-	-	-	-	-	-	-	-	-	33	6.8	-	-	49	6.1
11	-	-	13	4.5	-	-	-	-	-	-	-	-	-	-	29	6.0	-	-	42	5.2
12	-	-	19	6.7	-	-	1	12.5	-	-	1	4.0	-	-	30	6.2	-	-	51	6.4
13	-	-	6	2.1	-	-	-	-	-	-	1	4.0	-	-	26	5.3	-	-	33	4.1
14	-	-	14	4.9	-	-	-	-	-	-	-	-	-	-	24	4.9	-	-	38	4.7
15	-	-	13	4.5	-	-	-	-	-	-	2	8.0	-	-	26	5.3	-	-	41	5.1
16	-	-	11	3.9	-	-	-	-	-	-	-	-	-	-	11	2.3	-	-	22	2.7
17	-	-	13	4.5	-	-	-	-	-	-	-	-	-	-	8	1.6	-	-	21	2.6
18	-	-	9	3.2	-	-	-	-	-	-	-	-	-	-	11	2.3	-	-	20	2.5
19	-	-	2	0.7	-	-	-	-	-	-	-	-	-	-	5	1.0	-	-	7	0.9
20	-	-	6	2.1	-	-	-	-	-	-	-	-	-	-	4	0.8	-	-	10	1.2
23	-	-	1	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1
Total	20		285		2		8		3		25		47		486		72		804	
Combined total		305				10				28				533				876		

Table 2.--Monthly records of age and sex of fur seals off California

[Combined data for 1958, 1959, 1961, and 1964][1/]

Month	Seals collected	Males		Females		Females			
						Ages 1-4		Ages 5-20+	
	Number	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Jan.	546	4	0.7	542	99.3	53	9.8	489	90.2
Feb.	1,194	2	0.2	1,192	99.8	103	8.6	1,089	91.4
Mar.	611	5	0.8	606	99.2	90	14.9	516	85.1
Apr.	426	21	4.9	405	95.1	86	21.2	319	78.8
May	204	13	6.4	191	93.6	57	29.8	134	70.2
Total	2,981	45	1.5	2,936	98.5	389	13.2	2,547	86.8

[1/] Data for 1958, 1959, and 1961 are from North Pacific Fur Seal Commission Report on Investigations from 1958 to 1961.

and September were recorded. No mature follicles, ruptured follicles, or forming corpora lutea were noted in 2-year-old nulliparous animals. In a sample of 27 3-year-olds, the ovaries of 3 had either a ruptured follicle or a developing corpus luteum; 4 had at least one follicle greater than 5 mm. in diameter; and the ovaries of 20 contained follicles less than 5 mm. in diameter. We judge, therefore, that at least 3 and possibly 7 of the animals might have given birth to pups at age 4. Only one pregnant 4-year-old was collected.

Pregnancy rate.--The pregnancy rate of female seals collected in 1958-64 is shown in table 4. The rate in 1964, by area and month, and a comparison of these rates with the combined data for 1958-63 are given in appendix table 18. Several age classes of seals collected off California--particularly 4, 5, and 6--had lower pregnancy rates than seals of the same ages from other areas. A probable explanation of the difference in rates is that young nulliparous females and nonpregnant older females linger at the southern end of the migration range and form a greater proportion of spring collections than of winter collections.

In Bering Sea nulliparous females of ages 1 to 6 made up about equal percentages (23.3 and 23.7) of the collections in 1963 and 1964. In July, however, nulliparous females of these ages composed 39 percent of the 1964 catch as compared with 20 percent of the 1963 catch. Pregnancy rates for ages 3 to 6 were 0, 2.7, 33.3, and 74.6 in 1964 and 0, 7.1, 43.8, and 74.4 in 1963. The pregnancy rate of 4-year-old females varied in 1958-63 from a low of 1.0 to a high of 7.1; the rate among 5-year-old females varied from 20.6 to 56.1. These variations, which apparently are the result of sampling and distribution differences, are not known to be important.

The segregation of sexes demonstrated in the 1964 collections calls attention again to the problem of obtaining representative samples for determining pregnancy rates used in making population estimates. Year-to-year changes in rates can best be estimated from samples taken in the same area at the same time of year. Samples that vary in area and date of collection in different years cannot be compared safely.

Uterine horn of pregnancy and fetal sex ratio.--Data collected since 1958 indicate that pregnancies occur in the left uterine horn more often than in the right. In 1964, 55 percent of all pregnancies were in the left uterine horn. In 1962, 1963, and 1964, 53, 51, and 53 percent of the primiparous animals carried a pup in the left uterine horn in their first pregnancy.

Males and females were about equally represented among fetuses in 1958-64. In 1964, 51 percent were male.

Anomalies

Gooseneck barnacles and algae[5] are frequently attached and growing on the guard hairs of fur seals. Barnacles and algae appeared

[5] Algae were identified by Ann Helander, and barnacles by Dora P. Henry, Department of Oceanography, University of Washington, Seattle, Wash.

Table 3.--Tag recoveries from fur seals collected by the United States in 1964

[Figures in parentheses indicate animals that had lost tags; they are included in the totals.]

Age	Year of tagging[1]	Tag series	Seals tagged	Region						Seals collected in age group[2]		
				Calif.-Oreg.-Wash.		Alaska		Combined				
				♂	♀	♂	♀	♂	♀	♂	♀	♂ and ♀
Years			No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
<1	1964	Q	24,991	-	-	-	-	-	-	-	1	1
1	1963	P	24,971	-	-	-	-	-	-	7	16	23
2	1962	O	49,908	-	1	1	-	1	1	19	33	52
3	1961	N	49,921	2	[3] 6(2)	3	3	5	9(2)	31	59	90
4	1960	M	59,981	-	3	1	[4] 5(1)	1	8(1)	7	68	75
5	1959	L	49,881	-	1(1)	1(1)	1	1(1)	2(1)	5	73	78
6	1958	K	49,917	-	-		4(2)	-	4(2)	-	80	80
7	1957	J	49,842	-	-	-	4(2)	-	4(2)	1	70	71
8	1956	I	49,794	-	-	-	1	-	1	1	39	40
9	1955	[5] H	49,870	-	-	-	1	-	1	1	30	31
10	1954	G	10,000	-	-	-	-	-	-	-	49	49
11	1953	F	10,388	-	-	-	2(1)	-	2(1)	-	42	42
12	1952	E	19,979	-	1	-	1	-	2	-	51	51
13	1951	D	1,000	-	-	-	-	-	-	-	33	33
15	1949	CS	19,960	-	-	-	1	-	1	-	41	41
16	1948	B	19,532	-	-	-	-	-	-	-	22	22
17	1947	A	19,183	-	-	-	-	-	-	-	21	21
23	1941	USA	10,000	-	-	-	-	-	-	-	1	1
Total				2	12(3)	6(1)	23(6)	8(1)	35(9)	72	729	
Combined total				14(3)		29(7)		43(10)				801

[1] No seals were tagged before 1941, in 1942-46, or in 1950.

[2] Table does not include seals born in years when no tagging was done.

[3] Includes one seal tagged when 2 years old in 1963.

[4] Includes one 4-year-old seal tagged by U.S.S.R. (E 3858).

[5] Includes H-numbers 1-10,000 and numbers 10,001-50,000 without series letter.

with greater frequency on seals collected in April and May 1964 off California, Oregon, and Washington than on seals taken in the same areas during the winter and early spring in previous years.

From 19 May through 1 June, 98 seals were examined for barnacles and algae. Algae, in amounts from a few scattered spots to almost a complete cover, were growing on 26, and gooseneck barnacles were attached to the guard hairs of 6. Algae in samples taken from nine seals were identified as Ectocarpus sp. Pennate and centrate diatoms were also present in a few of the samples.

Table 4. --Pregnancy rate of seals collected by the United States in the eastern Pacific, 1958-64

Age	Number of females								Number pregnant								Percent pregnant							
	1958	1959	1960	1961	1962	1963	1964	Combined	1958	1959	1960	1961	1962	1963	1964	Combined	1958	1959	1960	1961	1962	1963	1964	Combined
Years																								
3	39	43	18	84	93	53	59	389	1	-	-	-	1	-	-	2	2.6	-	-	-	1.1	-	-	0.5
4	42	93	36	96	140	113	68	588	1	6	1	1	4	8	1	22	2.4	6.4	2.8	1.0	2.9	7.1	1.5	3.7
5	70	114	55	68	123	162	73	665	32	64	27	14	32	71	20	260	45.7	56.1	49.1	20.6	26.0	43.8	27.4	39.1
6	99	118	45	62	72	90	80	566	80	91	36	47	39	67	57	417	80.8	77.1	80.0	75.8	54.2	74.4	71.3	73.7
7	103	143	66	95	93	77	70	647	92	109	52	72	79	68	55	527	89.3	76.2	78.8	75.8	84.9	88.3	78.6	81 5
8	102	164	105	107	98	87	39	702	91	142	90	85	88	85	32	613	89.2	86.6	85.7	79.4	89.8	97.7	82.1	87.3
9	81	108	144	114	73	60	30	610	78	96	133	107	61	51	25	551	96.3	88.9	92.4	93.9	83.6	85.0	83.3	90.3
10	97	96	129	112	100	72	49	655	85	82	118	105	89	67	43	589	87.6	85.4	91.5	93.8	89.0	93.1	87.8	89.9
11	113	98	136	82	91	88	42	650	104	88	124	73	81	83	36	589	92.0	89.8	91.2	89.0	89.0	94.3	85.7	90.6
12	134	76	106	71	97	92	51	627	110	67	96	66	87	85	43	554	82.0	88.2	90.6	93.0	89.7	92.4	84.3	88.4
13	110	56	120	76	58	76	33	529	91	50	105	63	55	69	28	461	82.7	89.3	87.5	82.9	94.8	90.8	84.8	87.1
14	92	70	107	67	65	57	38	496	75	59	86	62	57	46	29	414	81.5	84.3	80.4	92.5	87.7	80.7	76.3	33.5
15	71	87	67	68	53	75	41	462	56	77	56	54	43	64	27	377	78.9	88.5	83.6	79.4	81.1	85.3	65.9	81.6
16	56	69	53	55	50	45	22	350	44	52	38	47	41	37	16	275	78.6	75.4	71.7	85.5	82.0	82.2	72.7	78.6
17	36	36	46	24	44	28	21	235	20	29	31	15	32	20	13	160	55.6	80.6	67.4	62.5	72.7	71.4	61.9	68.1
18	22	27	23	25	25	12	20	154	13	23	19	16	18	7	12	108	59.1	85.2	82.6	64.0	72.0	58.3	60.0	70.1
19	14	16	19	10	15	5	7	86	4	13	11	5	9	3	4	49	28.6	81.3	57.9	50.0	60.0	60.0	57.1	57.0
20	3	5	6	7	11	11	10	53	1	2	1	7	8	5	2	26	33.3	40.0	16.7	100.0	72.7	45.5	20.0	49.1
21	1	7	6	2	3	4	-	23	1	6	3	1	3	2	-	16	100.0	85.7	50.0	50.0	100.0	50.0	-	69.6
22	1	5	-	-	3	-	-	9	-	2	-	-	2	-	-	4	-	40.0	-	-	66.7	-	-	44.4
23	-	1	1	1	-	2	1	6	-	-	-	-	-	-	1	1	-	-	-	-	-	-	100.0	16.7
24	-	1	1	1	1	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,286	1,434	1,289	1,227	1,308	1,209	754	8,507	979	1,058	1,027	840	829	838	444	6,015	76.1	73.8	79.7	68.5	63.4	69.3	58.9	70.7
6-26 years	1,135	1,184	1,180	979	952	881	554	6,865	945	988	999	825	792	769	423	5,731	83.3	83.4	84.4	84.3	83.2	86.0	76.4	83.5

Fourteen samples of gooseneck barnacles were collected during the spring. Lepas pectinata pacifica, including some cyprid stages, were found in all samples, and two of the samples included Lepas anatifera. Most of the barnacles were small; the capitulum of the largest was only 8 mm. long. Gooseneck barnacles were also found on four seals collected in Bering Sea in July and August. L. p. pacifica was present in all four samples and L. anatifera in one.

Food

The food and feeding habits of fur seals off the Pacific coast of the United States were summarized by Fiscus, Baines, and Wilke (1964). Observations at sea and examinations of stomachs show that fur seals feed primarily at night and during early morning, although they feed actively throughout the day in areas where the food species remains in upper water layers in daylight. Usually stomach volumes were greatest early in the morning and decreased until late afternoon.

Stomachs from 876 fur seals from four areas were examined. Seventy-two percent of the stomachs contained at least trace[6] amounts of food. The percentages of stomachs containing food from the four areas were: California, 75; Oregon, 100; Washington, 79; and Bering Sea, 69. The samples off Oregon (10 stomachs) and Washington (28 stomachs) are too small for meaningful comparison with other data. The proportion of fish and squid in fur seal stomachs varies from year to year depending on the locality where seals are feeding. Collections made off the Continental Shelf usually contain more squid; those made on the Continental Shelf and slope usually contain more fish. The percent of fish and squid in 1964 were:

	Fish	Squid
	Percent	Percent
California	84.6	15.4
Oregon	100.0	Trace
Washington	93.8	6.2
Bering Sea	64.4	35.6

Food specimens found in fur seal stomachs were identified by (1) comparing them with preserved whole fish and skeletons and (2) using identification keys by Andriashev (1937; 1954), Berry (1912), Clemens and Wilby (1961), Clothier (1950), Evermann and Goldsborough (1907), Sasaki (1929), Schultz (1936), and Wilimovsky (1958).[7] To provide information on the size of the food species in fur seal stomachs, various counts, measurements, and weights of the remains of undigested specimens were taken whenever possible.

The following fishes and squids were identified from stomachs of fur seals collected in 1964. The common and scientific names of fish are from the published list (where applicable) of the American Fisheries Society (1960).

Lampetra tridentata (Pacific lamprey)
Alosa sapidissima (American shad)
Clupea harengus pallasi (Pacific herring)
Engraulis mordax (northern anchovy)
Oncorhynchus spp. (salmon)
Oncorhynchus gorbuscha (pink salmon)
Oncorhynchus keta (chum salmon)
Oncorhynchus nerka (sockeye salmon)
Mallotus villosus (capelin)
Thaleichthys pacificus (eulachon)
Bathylagidae (deepsea smelts)
Magnisudis barysoma (barracudinas)
Tarletonbeania crenularis (blue lanternfish)
Cololabis saira (Pacific saury)
Gadidae (codfishes)
Merluccius productus (Pacific hake)
Theragra chalcogrammus (walleye pollock)
Sebastodes spp. (rockfish)
Anoplopoma fimbria (sablefish)
Pleurogrammus monopterygius (Atka mackerel)
Cyclopteridae (lumpsuckers)
Aptocyclus ventricosus (smooth lumpsucker)
Ammodytes hexapterus (Pacific sand lance)
Anarhichadidae (wolffishes)
Anarhichas orientalis (Bering wolffish)
Pleuronectidae (righteye flounders)
Reinhardtius hippoglossoides (Greenland halibut)
Loligo opalescens (squid)
Onychoteuthis banksii (squid)
Gonatidae (squid)
Gonatus fabricii (squid)
Gonatus magister (squid)
Gonatopsis borealis (squid)

The detailed results of examinations of stomach contents are shown in tables 5-8. The locations where each food species occurred in stomachs are shown in appendix figures 1-8. Major food items usually remain the same each year in a given area, but individual rank may change. Figure 4 shows the percentage of stomach content by volume and percentage occurrence of food species that contributed more than 2 percent of the total volume.

[6] Trace, less than 5 cc.

[7] N. J. Wilimovsky. 1958. Provisional keys to the fishes of Alaska. U.S. Fish and Wildlife Service, Fisheries Research Laboratory, Juneau, Alaska, 113 p. [Processed.]

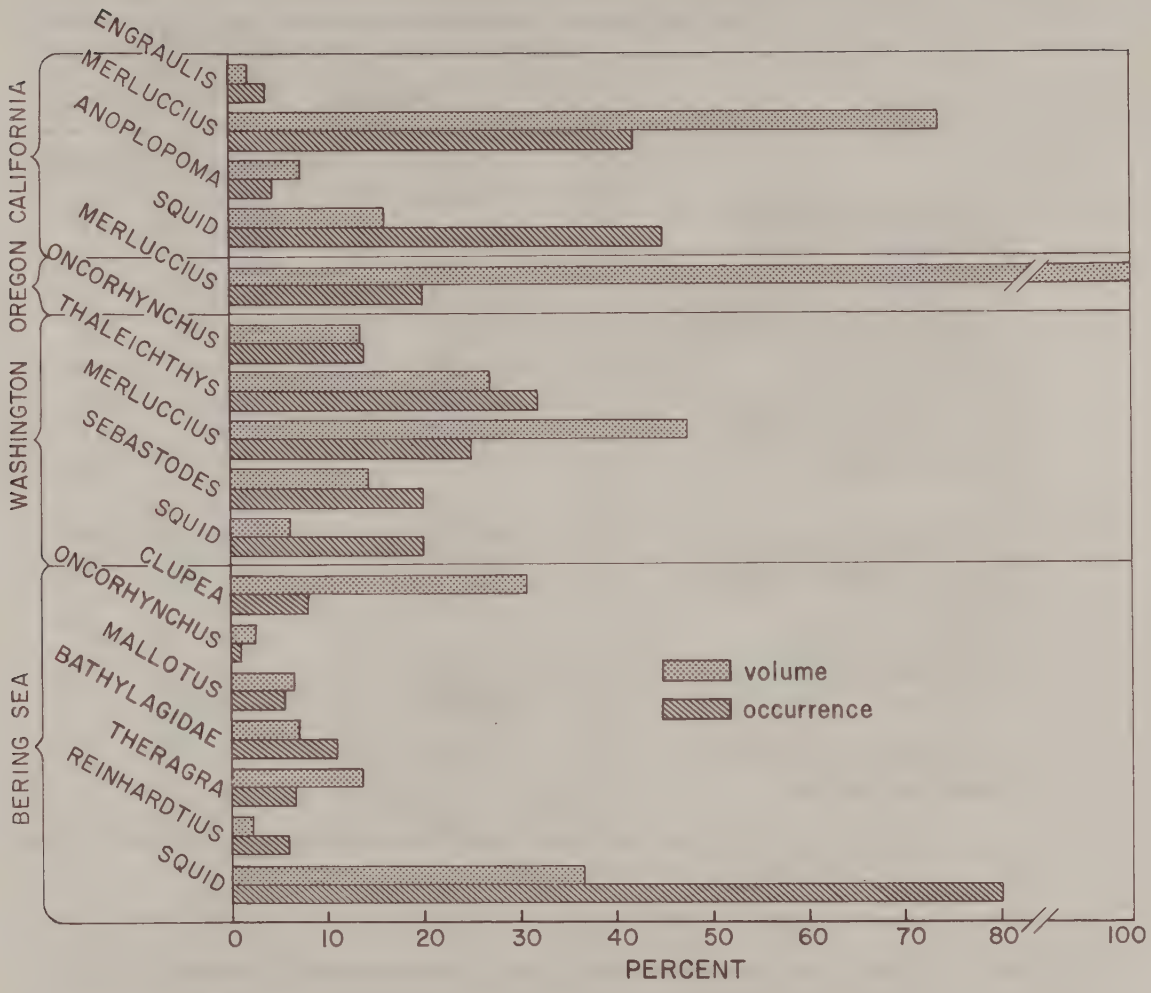

Figure 4.--Percentage of stomach content by volume and percentage occurrence of principal food species in fur seal stomachs in 1964, by area.

Table 5.--Stomach contents of fur seals collected off California, 1964

Food item	Spring April-May Volume Cc. [1]	Volume Percent	Frequency Number
Fish			
Lampetra tridentata	610	0.5	2
Engraulis mordax	2,466	2.1	11
Oncorhynchus sp.	170	0.1	2
Magnisudis barysoma	153	0.1	1
Tarletonbeania crenularis	132	0.1	1
Cololabis saira	483	0.4	2
Merluccius productus	84,890	73.8	129
Anoplopoma fimbria	8,617	7.5	13
Unidentified fish	T	-	62
Squid			
Loligo opalescens	14,789	12.9	74
Onychoteuthis banksii	2,787	2.4	27
Gonatidae	80	0.1	12
Gonatus fabricii	T	-	15
Unidentified squid	21	-	8
Total	115,198	100.0	
Stomachs with food	228		
Stomachs empty	77		
	305		

1/ T = Trace <5cc.

Table 6.--Stomach contents of fur seals collected off Oregon, 1964

Food item	Spring April-May Volume Cc. [1]	Volume Present	Frequency Number
Fish			
Merluccius productus	1,535	100.0	2
Unidentified fish	T	-	2
Squid			
Loligo opalescens	T	-	1
Onychoteuthis banksii	T	-	5
Gonatidae	T	-	2
Gonatus fabricii	T	-	4
Unidentified squid	T	-	3
Total	1,535	100.0	
Stomachs with food	10		
Stomachs empty	0		
	10		

1/ T = Trace <5cc.

Table 7. --Stomach contents of fur seals collected off Washington, 1964

Food item	Spring April-May			Summer June			Combined Spring-summer		
	Volume		Frequency	Volume		Frequency	Volume		Frequency
	Cc. [1]	Percent	Number	Cc.	Percent	Number	Cc.	Percent	Number
Fish									
Alosa sapidissima	-	-	1				-	-	1
Clupea harengus pallasi	20	0.3	1				20	0.3	1
Engraulis mordax	7	0.1	4				7	0.1	4
Oncorhynchus sp.	T	-	1	190	55.9	2	190	2.5	3
Oncorhynchus gorbuscha	893	12.3	1				893	11.7	1
Thaleichthys pacificus	1,307	18.0	9				1,307	17.2	9
Merluccius productus	3,483	47.8	4	150	44.1	3	3,633	47.7	7
Sebastodes sp.	1,092	15.0	1				1,092	14.3	1
Unidentified fish	T	-	2	T	-	1	T	-	3
Squid									
Loligo opalescens	76	1.0	3	T	-	1	76	1.0	4
Gonatidae	T	-	1				T	-	1
Gonatus fabricii	T	-	2				T	-	2
Gonatus magister	345	4.7	1				345	4.5	1
Gonatopsis borealis	57	0.8	1				57	0.7	1
Unidentified squid				T	-	1	T	-	1
Total	7,280	100.0		340	100.0		7,620	100.0	
Stomachs with food	18			4			22		
Stomachs empty	6			0			6		
	24			4			28		

[1] T = trace, <5 cc.

Table 8.--Stomach contents of fur seals collected in the Bering Sea, 1964

Food item	Summer July-August			Fall September			Combined Summer-Fall		
	Volume		Frequency	Volume		Frequency	Volume		Frequency
	Cc. 1/	Percent	Number	Cc.	Percent	Number	Cc.	Percent	Number
Fish									
Clupea harengus pallasi	70,109	32.7	44				70,109	30.9	44
Oncorhynchus sp.	225	0.1	4				225	0.1	4
Oncorhynchus gorbuscha	770	0.4	1				770	0.3	1
Oncorhynchus keta	4,215	2.0	1				4,215	1.9	1
Oncorhynchus nerka	298	0.1	1				298	0.1	1
Mallotus villosus	14,846	6.9	30	31	0.2	1	14,877	6.5	31
Bathylagidae	9,707	4.5	40	6,075	46.8	19	15,782	6.9	59
Gadidae	2,629	1.2	16	T	-	1	2,629	1.2	17
Theragra chalcogrammus	31,650	14.8	33	279	2.2	1	31,929	14.0	34
Pleurogrammus monopterygius	T	-	2	16	0.1	2	16	-	4
Cyclopteridae	10	-	1				10	-	1
Aptocyclus ventricosus	763	0.4	2				763	0.3	2
Ammodytes hexapterus	235	0.1	6				235	0.1	6
Anarhichadidae	62	-	4				62	-	4
Anarhichas orientalis	34	-	1				34	-	1
Pleuronectidae	T	-	2				T	-	2
Reinhardtius hippoglossoides	4,848	2.3	33				4,848	2.1	33
Unidentified fish	6	-	22	T	-	2	6	-	24
Squid									
Gonatidae	1,504	0.7	169	255	2.0	42	1,759	0.8	211
Gonatus fabricii	1,149	0.5	43	233	1.8	22	1,382	0.6	65
Gonatus magister	62,373	29.1	60	808	6.2	7	63,181	27.9	67
Gonatopsis borealis	9,091	4.2	60	5,275	40.7	23	14,366	6.3	83
Bird (feather)	-	-	2				-	-	2
Pebbles	-	-	15				-	-	15
Organic material	-	-	1	-	-	1	-	-	2
Isopoda	-	-	1				-	-	1
Mollusca	-	-	3				-	-	3
Pelecypoda	-	-	3				-	-	3
Cirripedia	-	-	2				-	-	2
Gastropoda	-	-	1				-	-	1
Total	214,524	100.0		12,972	100.0		227,496	100.0	
Stomachs with food	323			46			369		
Stomachs empty	157			7			164		
	480			53			533		

1/ T = trace, <5 cc.

Individual Food Items.--

Fish

Lampetra tridentata. Remains of the Pacific lamprey were found in stomachs of two fur seals collected on the Farallon grounds in 1964 (appendix fig. 1).

Alosa sapidissima. American shad was identified in one stomach collected off Washington (appendix fig. 2).

Clupea harengus pallasi. Pacific herring was in the stomach of one fur seal collected off Washington (appendix fig. 2) and in 44 stomachs collected in shallow-water areas (less than 100 fathoms) of sectors 4, 5, and 6, north and east of St. Paul Island, Alaska (appendix fig. 5). It ranked second in importance as a food species in the Bering Sea and represented 30.9 percent of the total volume.

Engraulis mordax. Northern anchovy was in stomachs of four fur seals collected off Washington; off California, ranked fourth in importance as a food species by volume (2.1 percent), occurring in 11 stomachs (appendix fig. 3).

Oncorhynchus spp. In stomachs of four fur seals collected off the Washington coast and in two stomachs from the Eureka grounds (appendix fig. 2); represented 14.2 percent of the total volume of food and ranked fourth in importance off Washington. One stomach contained pink salmon, O. gorbuscha.[8]

Salmon were in stomachs of seven fur seals from the Bering Sea in sector-zone 1-7, 2-2, and 3-3, and represented 2.4 percent of the total volume of food. One stomach contained a 4-year-old sockeye salmon, O. nerka; one contained a 2-year-old and a 3-year-old chum salmon, O. keta; and one contained pink salmon[9] (appendix fig. 5).

Mallotus villosus. Ranked second as a food species in the Bering Sea in 1963, but dropped to sixth place in 1964. A major concentration was found north of Cape Cheerful, Unalaska Island, Alaska, in sector-zone 1-7, in 1963, but only two stomachs contained the species in the same area in 1964. As shown in appendix figure 6, 24 of the 31 occurrences of capelin were in sector 5, zones 2, 3, and 4. Twenty undigested specimens from one fur seal stomach were 10.9 to 13.7 cm. long and averaged 8.5 g. in weight.

Thaleichthys pacificus. Found in nine stomachs of fur seals off Washington, where it formed 17.2 percent of the total volume and ranked second in importance as a food species (appendix fig. 1); eulachon was also found in fur seal stomachs in the same general area in 1961.[10]

Bathylagidae. Bathylagus was found in stomachs of 59 fur seals from deep water in sectors 1 and 2 in the Bering Sea (appendix fig. 5); it ranked fourth in importance as a food species and contributed 6.9 percent of the total volume of food. As in 1963 (when the genus was found in 92 stomachs), specific identification was not made because specimens sufficiently intact for identification were not found, and skeletons were not available for comparison. The species is believed to be that named Therobromus callorhinus (seal fish) from vertebrae found in fur seal stomachs (Jordan and Gilbert, 1899) but later reclassified as a species of Bathylagus (Chapman, 1943).

Magnisudis barysoma. Remains were identified from the stomach of one fur seal from the Eureka grounds in 1964 (appendix fig. 1). Nine occurences were recorded in stomachs of fur seals from the same area in 1959.[11]

Tarletonbeania crenularis. Identified from partially digested specimens in a stomach of one fur seal collected off California (appendix fig. 1). Previously blue lanternfish occurred in stomachs of seals off Oregon in 1959[12] and off California in 1961.[13]

Cololabis saira. A minor food in 1964 (only two occurrences), but third in importance as a food of fur seals off California in 1961[14] (appendix fig. 1).

Gadidae. Fish of the family Gadidae occurred in 189 stomachs in 1964. Of this total, 138 stomachs contained Merluccius productus and 34 contained Theragra chalcogrammus. Specimens in 17 stomachs were placed only in the family Gadidae; these were small fish (vertebral columns about 3 to 4 cm. long), from stomachs collected in the Bering Sea (appendix fig. 7).

Pacific hake was the leading food in stomachs of fur seals from California, Oregon,

[8] Specific identification of salmon were made from scales by Raymond E. Anas, Marine Mammal Biological Laboratory, Seattle, Wash.

[9] See footnote 8.

[10] Clifford H. Fiscus, Karl Niggol, and Ford Wilke. 1961. Pelagic fur seal investigations, California to British Columbia, 1961. U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries, Marine Mammal Biological Laboratory, Seattle, Wash. [Processed.]

[11] Karl Niggol, Clifford H. Fiscus, and Ford Wilke. 1959. Pelagic fur seal investigations, California, Oregon, and Washington, 1959. U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries Marine Mammal Biological Laboratory, Seattle, Wash. [Processed.]

[12] See footnote 11.

[13] See footnote 10.

[14] See footnote 10.

and Washington; it represented 73.8, 100.0, and 47.7 percent, respectively, of the total volume of food (appendix fig. 1).

Walleye pollock formed 14.0 percent of the total volume and ranked third as a food species in the Bering Sea (appendix fig. 6). It was one of the main foods of fur seals in the Bering Sea in 1962 and 1963 (Fiscus, Baines, and Wilke, 1964; Fiscus, Baines, and Kajimura, 1965).

Sebastodes spp. The remains of two rockfish were found in the stomach of a fur seal collected off Washington (appendix fig. 2).

Anaplopoma fimbria. Found in 13 fur seal stomachs (10 from the Eureka grounds) collected off California (appendix fig. 4); ranked third in importance as a food and formed 7.5 percent of the total volume of food.

Pleurogrammus monopterygius. Identified in stomachs of four fur seals from the Bering Sea (appendix fig. 8).

Cyclopteridae. Aptocyclus ventricosus occurred in stomachs of two seals from the Bering Sea (unidentifiable remains of a cyclopterid in a third stomach). One seal containing this species was from a shallow-water area northwest of St. Paul Island, in sector 4, zone 3; the other was from a deepwater area in sector 3, zone 3 (appendix fig. 8).

Ammodytes hexapterus. Six occurrences in fur seal stomachs in 1964 (appendix fig. 7). The species was also of minor importance as a food of fur seals in 1962 and 1963.

Anarhichadidae. The stomachs of five seals from the Bering Sea in shallow-water areas of sector 3, zone 3 and sector 5, zone 3 contained anarhichadids (appendix fig. 5). A specimen of Anarhichas orientalis from one of the stomachs[15] was 12.5 cm. long from tip of snout to end of hypural plate.[15] This is the first record of Anarhichas in fur seal stomachs since Lucas (1899) identified two specimens of A. lepturus. (A. lepturus is a synomym for A. orientalis--Jordan and Evermann, 1896.)

Pleuronectidae. Pleuronectidae were in the stomachs of 35 fur seals from Bering Sea. Fragments in two stomachs could be identified only to family, but remains in 33 stomachs were Greenland halibut (Reinhardtius hippoglossoides) (appendix fig. 8).

Greenland halibut occurred in the shallow-water areas of sectors 3, 4, 5, and 6, zones 1, 2, 3, and 4, in Bering Sea; it represented 2.1 percent of the total volume of food and ranked seventh in importance. It also was an important food item in 1963; it is the principal pleuronectid eaten by fur seals in the Bering Sea.

Greenland halibut is normally found in the North Atlantic but has been reported in the North Pacific and the Bering Sea in recent years. Hubbs and Wilimovsky (1964) studied the distribution, and variations in morphological and meristic characters, of the North Pacific and North Atlantic species. Best (1963) reported the species from the coast of California in 1962. Fiscus, Baines, and Kajimura (1965) recorded 16 occurrences in fur seal stomachs from the eastern Bering Sea in 1963.

Most fragments of Greenland halibut in fur seal stomachs to date have been from immature fish, but the size was generally larger in 1964 than in 1963. The 1963 specimens ranged from 4.5 to 6.0 cm. (tip of snout to end of hypural plate); in 1964, the length of the vertebral column of one specimen was 11.2 cm., and the length of the caudal vetebrae in seven others ranged from 6.3 to 8.8 cm.

Squids

Squids were the major food in fur seal stomachs from the Bering Sea in 1964, ranked second in California, were unimportant in Oregon, and ranked fifth in Washington. For the four areas combined, squids formed 28.2 percent of the total volume of food. The following five species of squids were identified: Loligo opalescens, Onychoteuthis banksii, Gonatus fabricii, Gonatus magister, and Gonatopsis borealis (appendix fig. 2, 3, 4, 6, 7, and 8).

Loligo opalescens ranked second as a food off California. It was in stomachs of 74 seals from the Eureka and Farallon grounds and made up 12.9 percent of the food volume; it was a minor food of fur seals off Oregon and Washington. The mean dorsal mantle length (DML) of 35 undigested specimens from one stomach was 12.6 cm. (range, 11.0 - 14.6 cm).

Onychoteuthis banksii occurred in 27 stomachs from the Eureka and Farallon grounds and in trace amounts in 5 stomachs from Oregon. Off California it represented 2.4 percent of the total volume of food. One specimen measured 22.0 cm. DML.

Gonatus fabricii and G. magister, and Gonatopsis borealis occurred in minor amounts off California, Oregon, and Washington. G. fabricii was in 65 fur seal stomachs from deep water in sectors 1, 2, and 3 of the Bering Sea. G. magister ranked second in importance as a food in stomachs from the Bering Sea, forming 27.9 percent of the total volume and 78.3 percent of the volume of squids; two of

[15] Identification was made by A. D. Welander, College of Fisheries, University of Washington, Seattle, Wash.

the 67 occurrences were in stomachs from shallow water near the Pribilof Islands (sector 3, zones 1 and 3), and the remainder from deep water. G. borealis was in 83 stomachs from the deepwater areas of sectors 1, 2, and 3 in the Bering Sea. These three species of squid appear to be equally distributed in the deepwater areas of the Bering Sea where fur seals were collected.

Miscellaneous stomach contents

Traces of unidentified bird feathers were found in two stomachs; unidentified organic material in one; a parasitic isopod, Rocinela belliceps, in one; fragments of unidentified Mollusca in three; fragments of pelecypods in three; a fragment of a gastropod shell in one; and fragments of Cirripedia in two stomachs.

Stones ranging from 3 to 40 mm. in diameter were in 15 fur seal stomachs from shallow water near the Pribilof Islands; 1 contained approximately 200 stones.

Relation of food of fur seals to commercial fisheries.--Salmon (Oncorhynchus spp.) were the most important commercial fish identified in stomachs of fur seals in 1964; these made up 1.9 percent of the total volume of food in 1964, and were in 13 of the 876 stomachs examined. The proportion of food volume contributed by a salmon has remained nearly constant in pelagic collections made by the United States since 1958; they have occurred in 112 of 8,380 (1.3 percent) stomachs examined.

The number of fur seals collected off Oregon (10) and Washington (28) in 1964 was small, and no conclusions about their relation to the commercial fisheries of the two States should be drawn from the stomach contents of these few animals.

The 10 leading commercial fish and shellfish from California waters in 1962, in order of pounds landed (California Department of Fish and Game, 1964) were: (1) Trachurus symmetricus (jack mackerel); (2) Scomber japonicus [diego] (Pacific mackerel); (3) Thunnus alalunga (albacore tuna); (4) Thunnus thynnus (bluefin tuna); (5) Sardinops caeruleus (sardine); (6) Loligo opalescens (squid); (7) all species of Sebastodes and Sebastolobus (rockfish); (8) Microstomus pacificus (Dover sole); (9) Oncorhynchus kisutch and O. tshawytscha (salmon); and (10) Parophrys vetulus (English sole).

Only Loligo and Oncorhynchus spp. were found both in seal stomachs and in the list of 10 leading commercial fish. Loligo represented 12.9 percent and Oncorhynchus 0.1 percent of the total volume of food in seal stomachs from California. The present harvest of Loligo is probably only a fraction of the possible yield from this species. The most abundant food species in fur seal stomachs off California was hake (Merluccius productus), which made up 73.8 percent of the total volume of food; it is of negligible commercial value in California at present.

Herring and walleye pollock have been important in catches of Soviet and Japanese bottomfishing fleets in the Bering Sea. For the first 9 months of 1964, the Japanese catch of herring was reported to be 42,000 metric tons and of walleye pollock, 117,000 metric tons (Commercial Fisheries Review, December 1964).

Herring ranked second in importance as a food of fur seals in the Bering Sea in 1964. The frequency of walleye pollock occurrence has declined in the stomachs of fur seals from the Bering Sea in the past few years; it was found in 109 of 229 stomachs containing food (48 percent) in 1960, 126 of 616 (20 percent) in 1962, 56 of 816 (9 percent) in 1963, and in 40 of 369 stomachs (11 percent) in 1964. The decline of this species as a fur seal food in the Bering Sea suggests that the population has been reduced, although we have no data to support this suggestion.

The records of volume and frequency of occurrence in seal stomachs indicate that predation by seals on commercially important species in the eastern Pacific is negligible.

SUMMARY

The seventh year of research on fur seals at sea under the Interim Convention on Conservation of North Pacific Fur Seals was conducted off California, Oregon, Washington, and Alaska in 1964.

Except for a few days off Oregon and Washington, the chartered purse seine vessel, M/V Harmony, worked mainly off California in April and May, to determine distribution, abundance, food, and late migration and movements of fur seals. Operations in Bering Sea in July, August, and September provided information on distribution and abundance of seals from the Aleutian Islands north to the Pribilof Islands, and on feeding grounds to the east, north, and west of the Pribilof Islands.

Observations began off California 11 April and ended 28 May. Some seals were still present off the central California coast between Cape San Martin and Pt. San Luis in mid-April. This area was a major wintering ground in January, February, and March 1959 and 1961. The Farallon and Eureka grounds off California were surveyed periodically in 1964. In general, fur seals were restricted to smaller areas and fewer seals were counted in April and May than during January to March in 1958, 1959, and 1961.

Studies in the eastern Bering Sea extended from 4 July to 8 September. Summer distribution of fur seals in the Bering Sea was similar to that in 1962 and 1963.

Fur seals were collected where the surface water temperatures ranged from 7° to 13° C.

Eighty-eight percent of the total seals observed in 1964 were in groups of three or less. The largest group sighted off California contained 10 seals; a group of 6 seals was the largest seen in the Bering Sea.

More males (20) were collected off California in 1964 than in 1958, 1959, or 1961. Four-year-old males were the oldest collected off California prior to the collection of a 5-year-old in 1964. Males form only a small part of the California fur seal population and appear later in the spring than the females. By April and May, most mature females are migrating northward and immature females are dominant.

The state of reproductive organs of male and female pairs collected at sea neither proved nor disproved mating at sea.

The percentage of tagged seals in collections by research vessels increased from 0.9 percent in 1958 to 4.9 percent in 1964. A 4-year-old female fur seal tagged on Bering Island by the U.S.S.R. was collected in 1964.

Nulliparous females formed about 40 percent of the females in April and May off California. The ovaries of 27 3-year-old females from the Bering Sea indicated that 7 of these animals might have given birth to pups at age 4.

The variations in pregnancy rates for seals off California and in the Bering Sea were irregular and probably reflect differences among subpopulations rather than a trend in the pregnancy rate.

Data collected since 1958 indicate that pregnancies occur in the left uterine horn more often than in the right. Numbers of male and female fetuses are approximately equal.

Algae and gooseneck barnacles were on guard hairs of more fur seals collected off California in 1964 than in previous years, when the seals were taken earlier in the year. Algae were identified as Ectocarpus sp. and barnacles as Lepas pectinata pacifica and L. anatifera.

Of the 876 stomachs examined in 1964, 72 percent contained food.

Thirty-three species, genera, or families of food were identified from fur seal stomachs collected in 1964.

Merluccius productus was the major food in fur seal stomachs collected off California, Oregon, and Washington. Squids were most important in stomachs from the Bering Sea, followed by Clupea harengus pallasi, Theragra chalcogrammus, Bathylagidae, and Mallotus villosus.

Anarhichadids, one of which was identified as Anarhichas orientalis, were identified for the first time in fur seal stomachs since reported by Lucas in 1899.

Miscellaneous objects in fur seal stomachs in 1964 included: unidentified bird feathers, organic material, a parasitic isopod, fragments of Mollusca and Cirripedia, and stones.

On the basis of volume and frequency of occurrence of commercially important food species in fur seal stomachs, predation by fur seals on commercial species appears negligible.

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APPENDIX A

Appendix table 1.--Number and relative abundance of seals seen, by 10-day periods, off California, Oregon, and Washington, 7 April to 1 June 1964, and in Bering Sea, 4 July to 8 September 1964

Area and period	Boat-hunting days [1]	Total seals seen	Seals seen per boat-hunting day	Seals seen per 10-day interval
	Number	Number	Number	Percent
California				
1-10 April	0.25	3	0.1	0.3
11-20 April	7.75	154	19.9	15.7
21-30 April	5.00	175	35.0	17.9
1-10 May	4.00	218	54.5	22.3
11-20 May	5.50	271	49.3	27.7
21-31 May	5.50	158	28.7	16.1
Total	28.00	979	35.0	100.0
Oregon				
1-10 April	2.00	18	9.0	94.7
20-31 May	2.00	1	0.5	5.3
Total	4.00	19	4.8	100.0
Washington				
1-10 April	2.00	54	27.0	80.6
20-31 May	1.00	7	7.0	10.4
1-10 June	1.00	6	6.0	9.0
Total	4.00	67	16.8	100.0
Bering Sea				
1-10 July	7.00	79	11.3	4.4
11-20 July	6.00	162	27.0	9.0
21-31 July	6.75	181	26.8	10.1
1-10 August	7.50	380	50.7	21.1
11-20 August	8.25	506	61.3	28.1
21-31 August	6.25	322	51.5	17.9
1-10 September	2.75	169	61.5	9.4
Total	44.50	1,799	40.4	100.0
Grand total	80.50	2,864	--	--

[1] A boat-hunting day is a day in which a vessel is used to collect or observe seals for 8 hours or more; units of boat-hunting days are 0.25, 0.50, 0.75, and 1.00.

Appendix table 2.--Number and relative abundance of seals collected, by 10-day periods, off California, Oregon, and Washington, 7 April to 1 June 1964, and in Bering Sea, 4 July to 8 September 1964

Area and period	Boat-hunting days[1]	Seals collected			Seals collected per boat hunting-day	
		Males	Females	Total		
California	Number	Number	Number	Number	Number	Percent
1-10 April	0.25	--	--	--	--	--
11-20 April	7.75	1	39	40	5.2	12.8
21-30 April	5.00	6	57	63	12.6	20.3
1-10 May	4.00	4	50	54	13.5	17.4
11-20 May	5.50	5	74	79	14.4	25.4
21-31 May	5.50	4	71	75	13.6	24.1
Total	28.00	20	291	311	11.1	100.0
Oregon						
1-10 April	2.00	2	7	9	4.5	90.0
20-31 May	2.00	--	1	1	0.5	10.0
Total	4.00	2	8	10	2.5	100.0
Washington						
1-10 April	2.00	1	18	19	9.5	67.8
20-31 May	1.00	-	5	5	5.0	17.9
1-10 June	1.00	2	2	4	4.0	14.3
Total	4.00	3	25	28	7.0	100.0
Bering Sea						
1-10 July	7.00	3	16	19	2.7	3.5
11-20 July	6.00	10	45	55	9.2	10.3
21-31 July	6.75	8	58	66	9.8	12.4
1-10 August	7.50	6	90	96	12.8	18.0
11-20 August	8.25	7	137	144	17.5	27.0
21-31 August	6.25	6	95	101	16.2	18.9
1-10 September	2.75	7	46	53	19.3	9.9
Total	44.50	47	487	534	12.0	100.0
Grand total	80.50	72	811	883	--	--

[1]A boat-hunting day is a day in which a vessel is used to collect or observe seals for 8 hours or more; units of boat-hunting days are 0.25, 0.50, 0.75, and 1.00.

Appendix table 3.--Number of seals per group among 2,864 seals sighted off California, Oregon, and Washington, 7 April to 1 June 1964, and in Bering Sea, 4 July to 8 September 1964

Area	Number of seals per group										Total
	1	2	3	4	5	6	7	8	9	10	
California											
Number of groups	292	116	61	31	7	8	3	3	-	2	523
Number of seals	292	232	183	124	35	48	21	24	-	20	979
Percent of seals	29.8	23.7	18.7	12.7	3.6	4.9	2.2	2.4	-	2.0	100.0
Oregon											
Number of groups	15	2	-	-	-	-	-	-	-	-	17
Number of seals	15	4	-	-	-	-	-	-	-	-	19
Percent of seals	78.9	21.1									100.0
Washington											
Number of groups	43	9	2	-	-	-	-	-	-	-	54
Number of seals	43	18	6	-	-	-	-	-	-	-	67
Percent of seals	64.2	26.9	8.9	-	-	-	-	-	-	-	100.0
Bering Sea											
Number of groups	1,010	253	70	13	3	1	-	-	-	-	1,350
Number of seals	1,010	506	210	52	15	6	-	-	-	-	1,799
Percent of seals	56.2	28.1	11.7	2.9	0.8	0.3	-	-	-	-	100.0
Combined Areas											
Number of groups	1,360	380	133	44	10	9	3	3	-	2	1,944
Number of seals	1,360	760	399	176	50	54	21	24	-	20	2,864
Percent of seals	47.5	26.5	13.9	6.2	1.8	1.9	0.7	0.8	-	0.7	100.0

Appendix table 4.--Mean lengths of pregnant fur seals in monthly U. S. collections in 1964

Age	April		May		July		Combined length		
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean	Standard deviation
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Cm.
5	2	118.0	4	119.2	3	117.0	9	118.2	4.4
6	6	122.5	7	124.7	5	122.2	18	123.3	6.2
7	8	117.7	9	122.7	6	124.5	23	121.4	5.8
8	3	123.0	6	122.5	1	124.0	10	122.8	4.8
9	1	134.0	4	125.5	1	121.0	6	126.2	5.5
10	3	126.0	12	124.9	3	130.7	18	126.1	4.7
11	2	131.0	8	128.4	-	-	10	128.9	6.2
12	8	124.1	8	127.7	-	-	16	125.9	4.6
13	3	122.7	4	124.5	1	133.0	8	124.9	5.1
14	2	129.5	9	129.8	2	131.0	13	129.9	3.5
15	5	126.4	5	128.4	-	-	10	127.4	3.3
16	3	130.3	6	129.5	-	-	9	129.8	5.9
17	2	136.0	7	127.7	-	-	9	129.6	6.6
18	2	130.5	3	131.0	-	-	5	130.8	6.3
20	1	130.0	1	129.0	-	-	2	129.5	0.7
23	-	-	1	135.0	-	-	1	135.0	-
Total	51		94		22		167		

Appendix table 5. --Mean weights of pregnant fur seals in monthly U. S. collections in 1964

Age	April		May		July		Combined weight		
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean	Standard deviation
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Kg.
5	2	29.5	4	33.7	3	36.7	9	33.8	6.4
6	6	32.8	7	41.7	5	40.9	18	38.5	6.3
7	8	31.1	9	39.6	6	43.2	23	37.6	6.6
8	3	34.3	6	38.3	1	41.0	10	37.4	4.9
9	1	45.0	4	45.0	1	38.0	6	43.8	3.8
10	3	40.3	12	43.0	3	52.7	18	44.1	5.4
11	2	44.0	8	45.0	-	-	10	44.8	4.3
12	8	38.9	8	46.9	-	-	16	42.9	6.4
13	3	40.0	4	48.2	1	54.5	8	45.9	7.8
14	2	40.0	9	48.1	2	52.7	13	47.6	6.3
15	5	43.8	5	48.8	-	-	10	46.3	7.3
16	3	49.7	6	50.2	-	-	9	50.0	3.0
17	2	49.5	7	47.1	-	-	9	47.7	7.2
18	2	49.5	3	50.7	-	-	5	50.2	5.3
20	1	44.0	1	51.0	-	-	2	47.5	4.9
23	-	-	1	58.0	-	-	1	58.0	-
Total	51		94		22		167		

Appendix table 6. --Mean lengths of post partum fur seals in monthly U. S. collections in 1964

Age	July		August		September		Combined length		
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean	Standard deviation
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Cm.
4	-	-	1	115.0	-	-	1	115.0	-
5	-	-	11	114.9	-	-	11	114.9	5.1
6	1	113.0	37	116.9	1	125.0	39	117.0	4.7
7	1	121.0	30	122.6	1	129.0	32	122.7	4.3
8	3	119.7	18	122.2	1	123.0	22	121.9	5.2
9	-	-	17	124.5	2	124.5	19	124.5	5.7
10	2	122.5	22	125.7	1	127.0	25	125.5	5.1
11	1	127.0	18	126.1	7	127.1	26	126.4	4.8
12	1	131.0	24	125.7	2	128.5	27	126.1	5.1
13	5	125.8	12	127.4	3	128.0	20	127.1	5.2
14	3	129.7	12	126.5	1	130.0	16	127.3	5.2
15	-	-	16	128.7	2	132.0	18	129.1	5.2
16	1	125.0	5	130.4	1	130.0	7	129.6	4.5
17	-	-	4	127.7	-	-	4	127.7	3.9
18	2	130.5	4	129.2	1	129.0	7	129.6	3.4
19	1	127.0	2	125.5	1	130.0	4	127.0	4.2
Total	21		233		24		278		

Appendix table 7. --Mean weights of post partum fur seals in monthly U. S. collections in 1964

Age	July		August		September		Combined weight		
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean	Standard deviation
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Kg.
4	-	-	1	25.0	-	-	1	25.0	-
5	-	-	11	26.1	-	-	11	26.1	3.4
6	1	25.0	37	28.9	1	33.0	39	28.9	3.9
7	1	33.0	30	32.7	1	35.0	32	32.8	3.0
8	3	28.7	18	35.1	1	38.0	22	34.3	5.5
9	-	-	17	35.8	2	36.5	19	35.8	6.1
10	2	31.0	22	35.5	1	37.0	25	35.2	5.5
11	1	42.5	18	37.8	7	38.7	26	38.2	4.7
12	1	40.0	24	37.6	2	41.0	27	37.9	4.8
13	5	35.4	12	37.5	3	37.7	20	37.0	4.7
14	3	36.3	12	38.6	1	48.0	16	38.7	5.0
15	-	-	16	42.7	2	45.5	18	43.0	6.3
16	1	40.0	5	40.8	1	43.0	7	41.0	3.0
17	-	-	4	37.2	-	-	4	37.2	1.9
18	2	42.5	4	43.7	1	40.0	7	42.9	3.9
19	1	44.0	2	39.5	1	43.0	4	41.5	3.7
Total	21		233		24		278		

Appendix table 8.--Mean lengths of nonpregnant fur seals in monthly U.S. collections in 1964

Age	April		May		June		July		August		September		Combined length		
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean	Standard deviation
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Cm.
Pup	-	-	-	-	-	-	-	-	-	-	1	74.0	1	74.0	-
1	7	75.1	9	76.2	-	-	-	-	-	-	-	-	16	75.7	3.5
2	9	90.1	15	90.7	-	-	-	-	4	98.5	5	99.4	33	92.8	4.9
3	9	97.0	22	99.8	-	-	13	107.7	13	105.1	2	107.0	59	102.5	6.0
4	14	105.6	15	108.5	2	113.0	16	112.4	20	111.2	-	-	67	109.8	4.6
5	11	111.8	14	112.2	-	-	14	114.9	13	114.8	1	117.0	53	113.6	5.0
6	3	116.3	5	114.4	-	-	3	117.7	11	120.2	1	117.0	23	118.0	5.3
7	1	112.0	1	116.0	-	-	6	121.3	7	122.7	-	-	15	121.0	4.8
8	2	123.0	-	-	-	-	2	125.0	3	125.7	-	-	7	124.7	2.8
9	-	-	1	124.0	-	-	1	127.0	3	123.3	-	-	5	124.2	2.7
10	-	-	1	122.0	-	-	3	123.3	1	124.0	1	127.0	6	123.8	2.6
11	1	127.0	2	131.5	-	-	1	129.0	1	124.0	1	118.0	6	126.8	5.3
12	-	-	5	126.0	-	-	1	131.0	1	130.0	1	128.0	8	127.4	4.6
13	-	-	-	-	-	-	2	127.5	2	129.0	1	123.0	5	127.2	2.7
14	3	123.3	-	-	-	-	3	133.7	1	127.0	2	130.5	9	128.8	5.6
15	3	126.3	2	131.0	-	-	3	121.0	3	129.3	2	132.0	13	127.4	5.1
16	1	129.0	1	126.0	-	-	1	132.0	2	130.0	1	133.0	6	130.0	2.5
17	1	129.0	3	133.3	-	-	2	132.5	-	-	2	130.5	8	131.9	2.0
18	-	-	4	126.0	-	-	3	129.7	1	140.0	-	-	8	129.1	6.0
19	-	-	2	128.5	-	-	1	133.0	-	-	-	-	3	130.0	5.2
20	3	126.7	1	130.0	-	-	1	133.0	2	135.0	1	130.0	8	130.4	4.2
Total	68		103		2		76		88		22		359		

Appendix table 9.--Mean weights of nonpregnant fur seals in monthly U.S. collections in 1964

Age	April		May		June		July		August		September		Combined weight		
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals		Standard deviation
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Kg.
Pup	-	-	-	-	-	-	-	-	-	-	1	7.5	1	7.5	-
1	7	8.7	9	9.1	-	-	-	-	-	-	-	-	16	8.9	1.5
2	9	13.0	15	12.6	-	-	-	-	4	17.0	5	17.6	33	14.0	2.7
3	9	17.0	22	17.6	-	-	13	21.0	13	20.8	2	22.0	59	19.1	2.8
4	14	19.9	15	21.1	2	23.5	16	23.3	20	23.6	-	-	67	22.2	3.2
5	11	24.4	14	25.2	-	-	14	25.9	13	26.6	1	28.0	53	25.6	3.0
6	3	26.3	5	24.8	-	-	3	28.2	11	30.8	1	26.0	23	28.3	3.7
7	1	22.0	1	25.0	-	-	6	30.1	7	32.7	-	-	15	30.4	4.8
8	2	33.0	-	-	-	-	2	35.5	3	35.0	-	-	7	34.6	3.4
9	-	-	1	36.0	-	-	1	36.0	3	32.0	-	-	5	33.6	3.9
10	-	-	1	26.0	-	-	3	30.8	1	31.0	1	39.0	6	31.4	4.5
11	1	35.0	2	41.5	-	-	1	44.0	1	38.0	1	29.0	6	38.2	5.5
12	-	-	5	34.2	-	-	1	37.0	1	38.0	1	42.0	8	36.0	3.0
13	-	--	-	-	-	-	2	42.0	2	38.0	1	38.0	5	39.6	2.7
14	3	39.3	-	-	-	-	3	41.7	1	34.0	2	40.0	9	39.7	3.6
15	3	38.0	2	43.5	-	-	3	37.0	3	43.8	2	44.0	13	40.9	5.2
16	1	38.0	1	34.0	-	-	1	43.5	2	38.0	1	38.0	6	38.2	3.9
17	1	33.0	3	48.7	-	-	2	40.5	-	-	2	40.5	8	42.6	6.2
18	-	-	4	40.0	-	-	3	40.3	1	47.0	-	-	8	41.0	3.4
19	-	-	2	42.5	-	-	1	41.5	-	-	-	-	3	42.2	6.5
20	3	37.3	1	52.0	-	-	1	45.0	2	40.5	1	41.0	8	41.4	6.0
Total	68		103		2		76		88		22		359		

Appendix table 10.--Mean lengths of male fur seals in monthly U.S. collections in 1964

Age	April		May		June		July		August		September		Combined length		
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean	Standard deviation
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Cm.
1	3	82.0	3	87.3	-	-	-	-	-	-	1	96.0	7	86.3	7.0
2	2	91.0	4	93.7	2	102.5	2	106.0	7	105.6	2	113.0	19	102.1	7.6
3	5	103.4	5	107.8	-	-	16	111.6	4	113.2	1	113.0	31	109.9	5.5
4	-	-	-	-	-	-	3	124.0	3	110.7	1	115.0	7	117.0	10.5
5	-	-	1	129.0	-	-	-	-	4	141.0	-	-	5	138.6	5.9
7	-	-	-	-	-	-	-	-	1	160.0	-	-	1	160.0	-
8	-	-	-	-	-	-	-	-	-	-	1	152.0	1	152.0	-
9	-	-	-	-	-	-	-	-	-	-	1	164.0	1	164.0	-
Total	10		13		2		21		19		7		72		

Appendix table 11.--Mean weights of male fur seals in monthly U.S. collections in 1964

Age	April		May		June		July		August		September		Combined weight		
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean	Standard deviation
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Kg.
1	3	11.0	3	12.0	-	-	-	-	-	-	1	18.0	7	12.4	3.0
2	2	14.5	4	19.7	2	18.0	2	22.5	7	19.1	2	26.0	19	19.7	4.0
3	5	20.2	5	22.6	-	-	16	24.7	4	26.2	1	24.0	31	23.8	4.0
4	-	-	-	-	-	-	3	35.0	3	26.0	1	30.0	7	30.4	7.2
5	-	-	1	37.0	-	-	-	-	4	48.7	-	-	5	46.4	8.8
7	-	-	-	-	-	-	-	-	1	77.0	-	-	1	77.0	-
8	-	-	-	-	-	-	-	-	-	-	1	64.0	1	64.0	-
9	-	-	-	-	-	-	-	-	-	-	1	65.0	1	65.0	-
Total	10		13		2		21		19		7		72		

Appendix table 12. --Mean lengths and weights of fur seal fetuses collected by the United States in 1964

Period	Male			Female		
	Fetuses	Mean Length	Mean Weight	Fetuses	Mean Length	Mean Weight
	Number	Cm.	Kg.	Number	Cm.	Kg.
1-10 Apr.	6	43.3	1.9	4	40.0	1.6
11-20 "	11	44.2	2.1	10	44.5	2.0
21-30 "	10	50.8	3.0	10	48.3	2.5
1-10 May	14	52.8	3.1	9	49.9	2.9
11-20 "	24	55.4	3.8	20	53.6	3.5
21-31 "	13	57.2	4.2	14	53.8	3.5
1-10 July	2	65.7	6.0	8	62.2	5.0
11-20 "	7	65.4	6.1	4	61.9	5.2
21-31 "	-	-	-	1	64.0	5.1
Total	87			80		
Grand total	167					

Appendix table 13.--Reproductive condition of female fur seals in monthly U.S. collections off California in 1964

Age	Nulliparous	Primiparous			Multiparous			Total
		Nonpregnant	Pregnant		Nonpregnant	Pregnant		
Years	Number	Number	Number	Percent	Number	Number	Percent	Number
				April				
1	1	-	-	-	-	-	-	1
2	6	-	-	-	-	-	-	6
3	6	-	-	-	-	-	-	6
4	12	-	-	-	-	-	-	12
5	11	-	2	100.0	-	-	-	13
6	2	-	1	100.0	-	1	100.0	4
7	1	-	6	100.0	-	1	100.0	8
8	1	1	1	50.0	-	1	100.0	4
9	-	-	-	-	-	1	100.0	1
10	-	-	-	-	-	3	100.0	3
11	-	-	-	-	1	2	66.7	3
12	-	-	-	-	-	6	100.0	6
13	-	-	-	-	-	2	100.0	2
14	-	-	-	-	3	2	40.0	5
15	-	-	-	-	3	4	57.1	7
16	-	-	-	-	1	3	75.0	4
17	-	-	-	-	1	2	66.7	3
18	-	-	-	-	-	2	100.0	2
19	-	-	-	-	-	-	-	-
20	-	-	-	-	3	1	25.0	4
23	-	-	-	-	-	-	-	-
Total	40	1	10		12	31		94
Percent				90.9			72.1	
				May				
1	8	-	-	-	-	-	-	8
2	14	-	-	-	-	-	-	14
3	21	-	-	-	-	-	-	21
4	14	-	-	-	-	-	-	14
5	13	-	2	100.0	1	2	66.7	18
6	5	-	3	100.0	-	4	100.0	12
7	1	-	4	100.0	-	4	100.0	9
8	-	-	2	100.0	-	4	100.0	6
9	-	-	-	-	1	4	80.0	5
10	-	-	-	-	1	12	92.3	13
11	-	1	-	-	1	8	88.9	10
12	-	-	-	-	5	8	61.5	13
13	-	-	-	-	-	4	100.0	4
14	-	-	-	-	-	9	100.0	9
15	-	-	-	-	2	4	66.7	6
16	-	-	-	-	1	6	85.7	7
17	-	-	-	-	3	7	70.0	10
18	-	-	-	-	4	3	42.9	7
19	-	-	-	-	2	-	-	2
20	-	-	-	-	1	1	50.0	2
23	-	-	-	-	-	1	100.0	1
Total	76	1	11		22	81		191
Percent				91.7			78.6	

Appendix table 14.--Reproductive condition of female fur seals in monthly U.S. collections off Oregon in 1964

Age	Nulliparous	Primiparous			Multiparous			Total
		Nonpregnant	Pregnant		Nonpregnant	Pregnant		
Years	Number	Number	Number	Percent	Number	Number	Percent	Number
				April				
2	2	-	-	-	-	-	-	2
3	1	-	-	-	-	-	-	1
4	2	-	-	-	-	-	-	2
7	-	-	1	100.0	-	-	-	1
12	-	-	-	-	-	1	100.0	1
Total	5		1			1		7
Percent				100.0			100.0	
				May				
7	-	-	1	100.0	-	-	-	1
Total			1					1
Percent				100.0				

Appendix table 15.--Reproductive condition of female fur seals in monthly U.S. collections off Washington in 1964

Age	Nulliparous	Primiparous			Multiparous			Total
		Nonpregnant	Pregnant		Nonpregnant	Pregnant		
Years	Number	Number	Number	Percent	Number	Number	Percent	Number
				April				
1	6	-	-	-	-	-	-	6
2	1	-	-	-	-	-	-	1
3	2	-	-	-	-	-	-	2
6	1	-	4	100.0	-	-	-	5
8	-	-	-	-	-	1	100.0	1
12	-	-	-	-	-	1	100.0	1
13	-	-	-	-	-	1	100.0	1
15	-	-	-	-	-	1	100.0	1
Total	10		4			4		18
Percent				100.0			100.0	
				May				
1	1	-	-	-	-	-	-	1
2	1	-	-	-	-	-	-	1
3	1	-	-	-	-	-	-	1
4	1	-	-	-	-	-	-	1
15	-	-	-	-	-	1	100.0	1
Total	4					1		5
Percent							100.0	
				June				
4	2	-	-	-	-	-	-	2
Total	2							2
Percent								

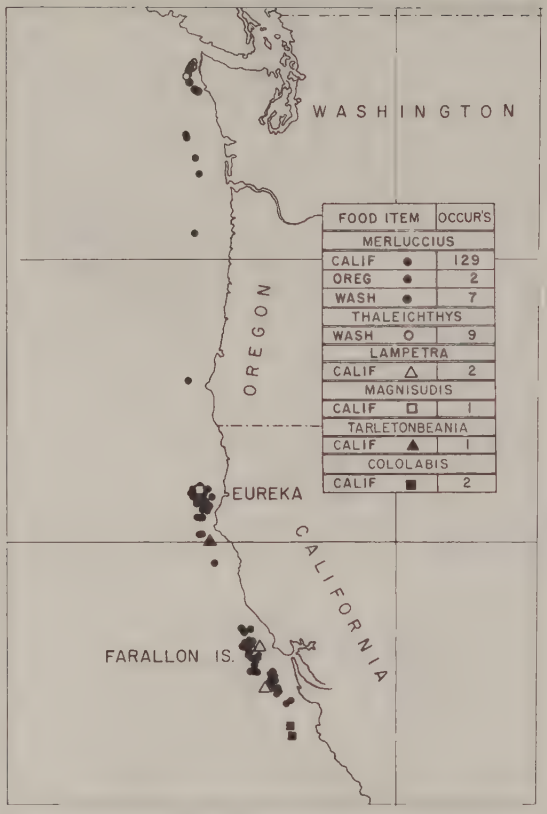
Appendix table 16.--Reproductive condition of female fur seals in monthly U.S. collections in Bering Sea in 1964

Age	Nulliparous	Primiparous			Multiparous			Total
		Nonpregnant	Pregnant		Nonpregnant	Pregnant		
Years	Number	Number	Number	Percent	Number	Number	Percent	Number
				July				
3	13	-	-	-	-	-	-	13
4	16	-	-	-	-	-	-	16
5	14	-	3	100.0	-	-	-	17
6	3	-	2	100.0	-	4	100.0	9
7	5	-	4	100.0	1	3	75.0	13
8	-	-	1	100.0	2	3	60.0	6
9	1	-	-	-	-	1	100.0	2
10	-	-	-	-	3	5	62.5	8
11	-	-	-	-	1	1	50.0	2
12	-	-	-	-	1	1	50.0	2
13	-	-	-	-	2	6	75.0	8
14	-	-	-	-	3	5	62.5	8
15	-	-	-	-	3	-	-	3
16	-	-	-	-	1	1	50.0	2
17	-	-	-	-	2	-	-	2
18	-	-	-	-	3	2	40.0	5
19	-	-	-	-	1	1	50.0	2
20	-	-	-	-	1	-	-	1
Total	52	-	10		24	33		119
Percent				100.0			57.9	
				August				
2	4	-	-	-	-	-	-	4
3	13	-	-	-	-	-	-	13
4	20	-	1	100.0	-	-	-	21
5	13	-	10	100.0	-	1	100.0	24
6	9	2	24	92.3	-	13	100.0	48
7	4	1	7	87.5	2	23	92.0	37
8	2	-	5	100.0	1	13	92.8	21
9	1	-	2	100.0	2	15	88.2	20
10	-	-	-	-	1	22	95.6	23
11	-	-	-	-	1	18	94.7	19
12	-	-	-	-	1	24	96.0	25
13	-	-	-	-	2	12	85.7	14
14	-	-	-	-	1	12	92.3	13
15	-	-	-	-	3	16	84.2	19
16	-	-	-	-	2	5	71.4	7
17	-	-	-	-	-	4	100.0	4
18	-	-	-	-	1	4	80.0	5
19	-	-	-	-	-	2	100.0	2
20	-	-	-	-	2	-	-	2
Total	66	3	49		19	184		321
Percent				94.2			90.6	
				September				
Pup	1	-	-	-	-	-	-	1
Years								
1	-	-	-	-	-	-	-	-
2	5	-	-	-	-	-	-	5
3	2	-	-	-	-	-	-	2
4	-	-	-	-	-	-	-	
5	1	-	-	-	-	-	-	1
6	1	-	1	100.0	-	--	-	2
7	-	-	-	-	-	1	100.0	1
8	-	-	-	-	-	1	100.0	1
9	-	-	1	100.0	-	1	100.0	2
10	1	-	-	-	-	1	100.0	2
11	-	-	-	-	1	7	87.5	8
12	-	-	-	-	1	2	66.7	3
13	-	-	-	-	1	3	75.0	4
14	-	-	-	-	2	1	33.3	3
15	-	-	-	-	2	2	50.0	4
16	-	-	-	-	1	1	50.0	2
17	-	-	-	-	2	-	-	2
18	-	-	-	-	-	1	100.0	1
19	-	-	-	-	-	1	100.0	1
20	-	-	-	-	1	-	-	1
23	-	-	-	-	-	-	-	-
Total	11	-	2		11	22		46
Percent				100.0			66.7	

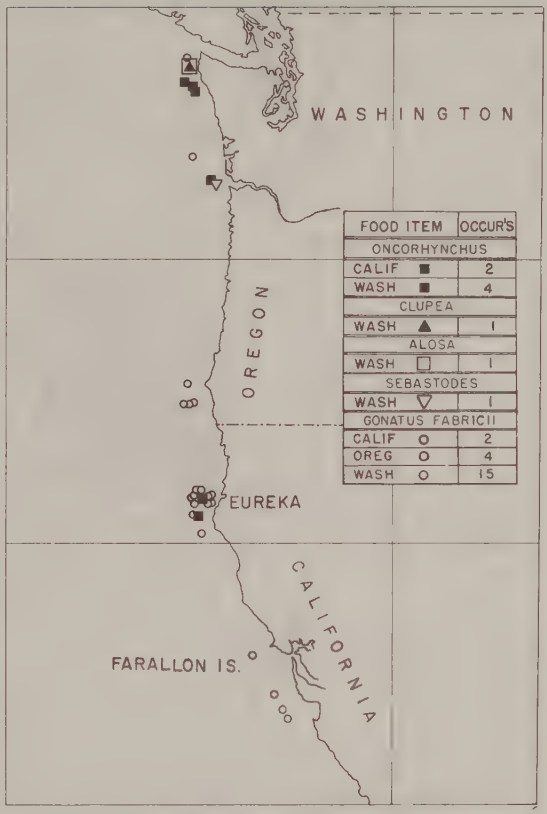
Appendix table 17. --Pregnancy rates of seals collected by the United States in 1964, by area and month

Age	California						Bering Sea									Combined data		
	April			May			July			August			September			Calif. 1964	Bering Sea 1964	1958-63 pelagic collections 1/
	Number	Number pregnant	Percent pregnant	Number	Number pregnant	Percent pregnant	Number	Number pregnant	Percent pregnant	Number	Number pregnant	Percent pregnant	Number	Number pregnant	Percent pregnant	Percent pregnant	Percent pregnant	Percent pregnant
3	6	-	-	21	-	-	13	-	-	13	-	-	2	-	-	0	0	0.7
4	12	-	-	14	-	-	16	-	-	21	1	4.8	-	-	-	0	2.7	4.0
5	5	2	40.0	18	4	22.2	17	3	17.6	24	11	45.8	1	-	-	19.4	33.3	40.5
6	4	2	50.0	12	7	58.3	9	6	66.7	48	37	77.1	2	1	50.0	56.3	74.6	74.1
7	8	7	87.5	9	8	88.8	13	7	53.8	37	30	81.1	1	1	100.0	88.2	74.5	81.8
8	4	2	50.0	6	6	100.0	6	4	66.7	21	18	85.7	1	1	100.0	80.0	82.1	87.6
9	1	1	100.0	5	4	80.0	2	1	50.0	20	17	85.0	2	2	100.0	83.3	83.3	90.7
10	3	3	100.0	13	12	92.3	8	5	62.5	23	22	95.7	2	1	50.0	93.8	87.9	90.1
11	3	2	66.7	10	8	80.0	2	1	50.0	19	18	94.7	8	7	87.5	76.9	89.7	91.0
12	6	6	100.0	13	8	61.5	2	1	50.0	25	24	96.0	3	2	66.7	73.7	90.0	88.7
13	2	2	100.0	4	4	100.0	8	6	75.0	14	12	85.7	4	3	75.0	100.0	80.8	87.3
14	5	2	40.0	9	9	100.0	8	5	62.5	13	12	92.3	3	1	33.3	78.6	75.0	79.4
15	7	4	57.1	6	4	66.7	3	0	0	19	16	84.2	4	2	50.0	61.5	69.2	82.9
16	4	3	75.0	7	6	85.7	2	1	50.0	7	5	71.4	2	1	50.0	81.8	63.6	79.0
17	3	2	66.7	10	7	70.0	2	0	0	4	4	100.0	2	0	0	69.2	50.0	68.7
18	2	2	100.0	7	3	42.9	5	2	40.0	5	4	80.0	1	1	100.0	55.5	63.6	71.6
19	-	-	-	2	0	0	2	1	50.0	2	2	100.0	1	1	100.0	0	80.0	57.0
20	4	1	25.0	2	1	50.0	1	0	0	2	0	0	1	0	0	33.3	0	55.8
23	-	-	-	1	1	100.0	-	-	-	-	-	-	-	-	-	100.0	-	-

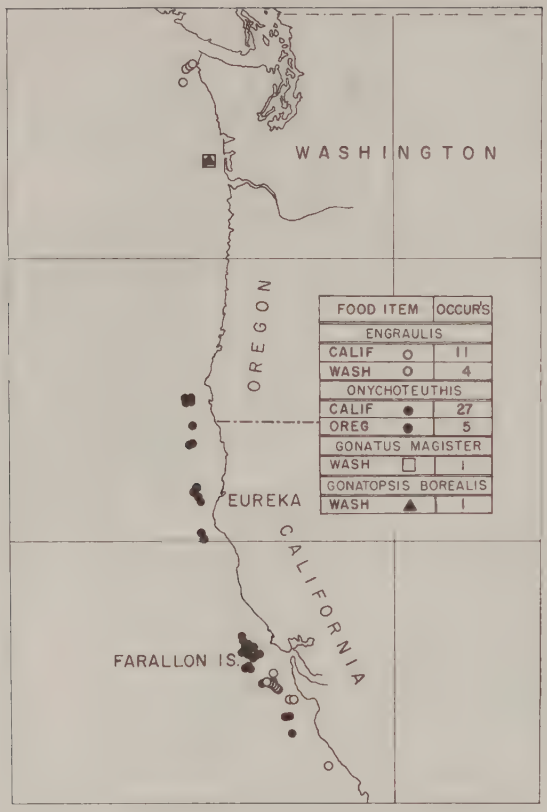
1/ Data from 1963 pelagic report (Fiscus et al., 1965).



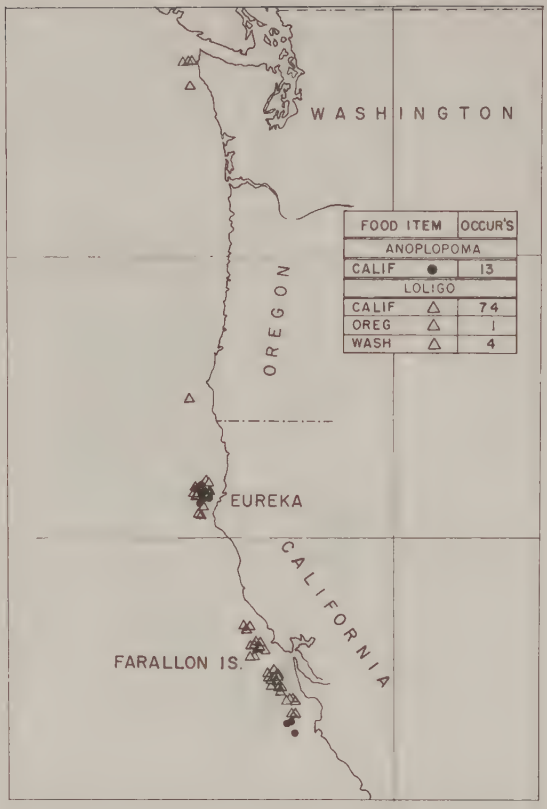
Appendix figure 1.--Locations where fur seal stomachs collected in 1964 off California, Oregon, and Washington contained Lampetra tridentata, Thaleichthys pacificus, Magnisudis barysoma, Tarletonbeania crenularis, Cololabis saira, and Merluccius productus.



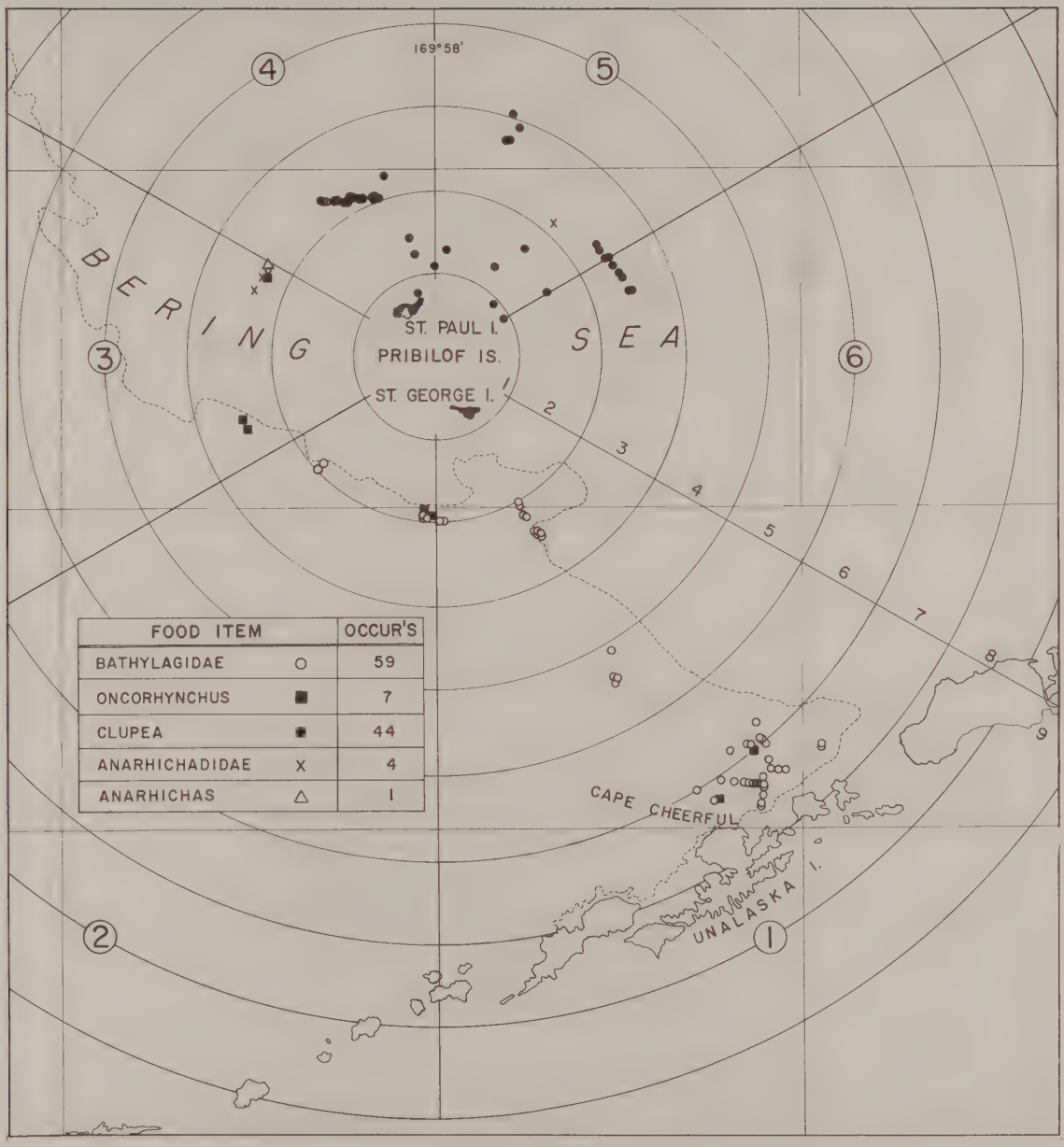
Appendix figure 2.--Locations where fur seal stomachs collected in 1964 off California, Oregon, and Washington contained Alosa sapidissima, Clupea harengus pallasi, Oncorhynchus spp., Sebastodes spp., and Gonatus fabricii.



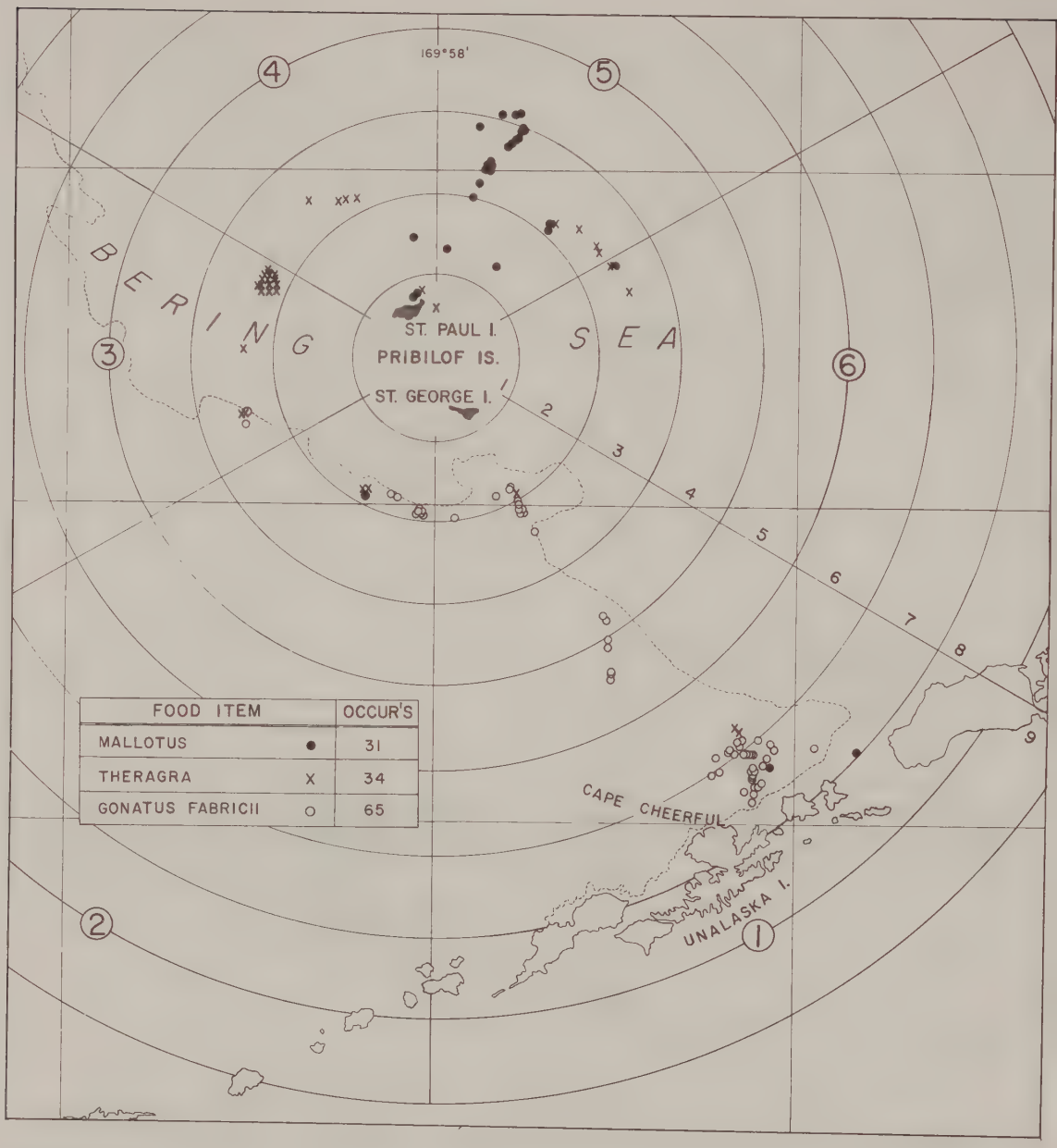
Appendix figure 3.--Locations where fur seal stomachs collected in 1964 off California, Oregon, and Washington contained Engraulis mordax, Onychoteuthis banksii, Gonatus magister, and Gonatopsis borealis.



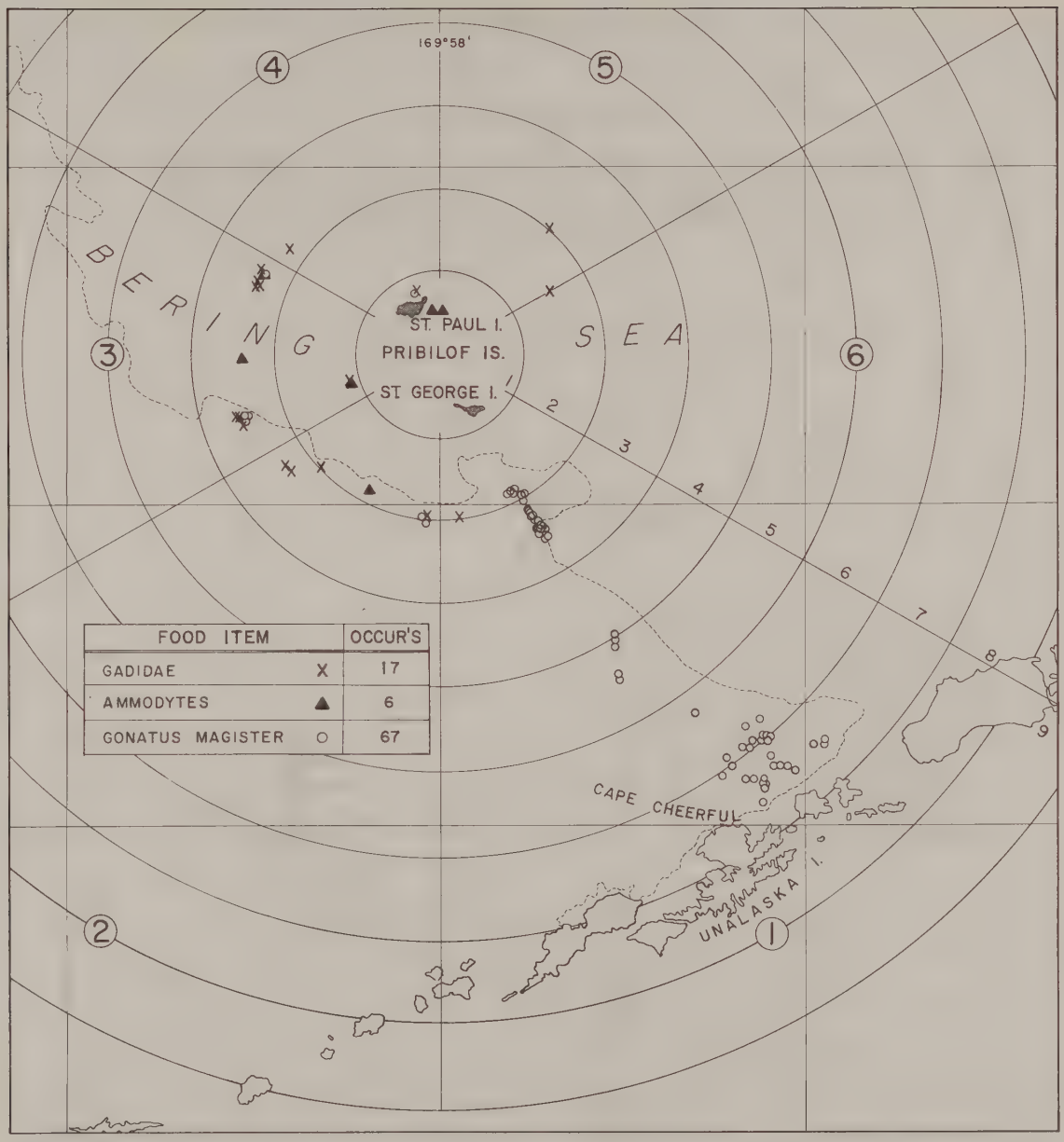
Appendix figure 4.--Locations where fur seal stomachs collected in 1964 off California, Oregon, and Washington contained Anoplopoma fimbria, and Loligo opalescens.



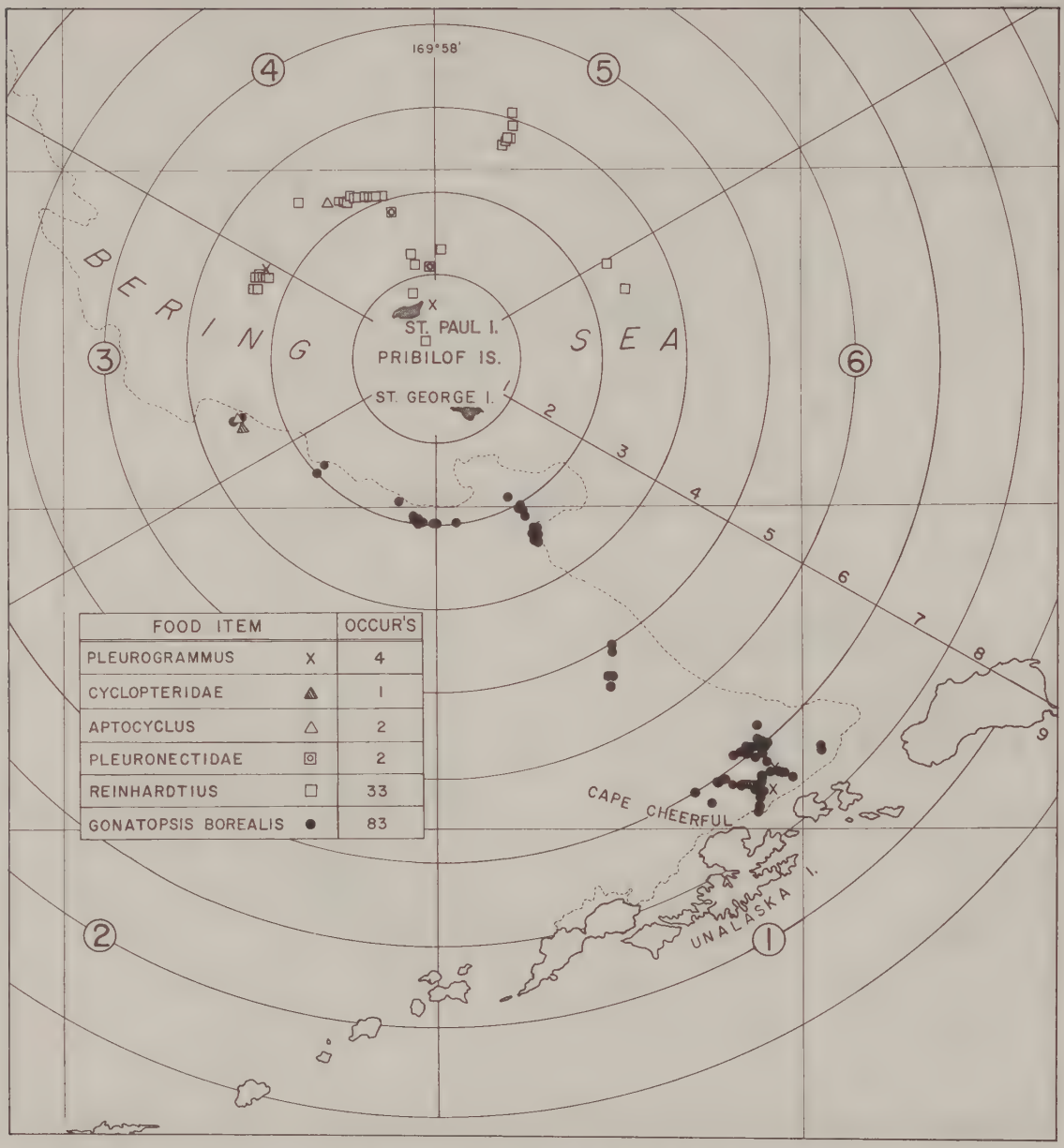
Appendix figure 5.--Locations where fur seal stomachs collected in 1964 in the Bering Sea contained Clupea harengus pallasi, Oncorhynchus spp., Bathylagidae, Anarhichadidae, and Anarhichas orientalis. The 100-fathom contour is shown as a dotted line.



Appendix figure 6.--Locations where fur seal stomachs collected in 1964 in the Bering Sea contained Mallotus villosus, Theragra chalcogrammus, and Gonatus fabricii. The 100-fathom contour is shown as a dotted line.



Appendix figure 7.--Locations where fur seal stomachs collected in 1964 in the Bering Sea contained Gadidae, Ammodytes hexapterus, and Gonatus magister. The 100-fathom contour is shown as a dotted line.



Appendix figure 8.--Locations where fur seal stomachs collected in 1964 in the Bering Sea contained Pleurogrammus monopterygius, Cyclopteridae, Aptocyclus ventricosus, Pleuronectidae, Reinhardtius hippoglossoides, and Gonatopsis borealis. The 100-fathom contour is shown as a dotted line.

APPENDIX B

BEHAVIOR NOTES

Behavior of fur seals has been studied in detail only on land. Descriptions of behavior at sea have dealt mainly with reactions of seals to disturbance or pursuit by a ship. Behavior of seals is likely to vary from that observed daily on the open sea when floating debris such as logs, lumber, and kelp is present. Appendix table 19 is a compilation of observations in 1964.

Appendix table 19.--Observations of unusual fur seal behavior at sea, 1964

Date of observation	Number observed	Tag number, if animal collected	Locality where observed	Observation
7 April.....	1		Off Cape Flattery, Wash.	Resting near log, hid behind it when disturbed, would not leave vicinity of log.
17 May.....	1		Eureka grounds	Resting with head on piece of lumber.
27 May.....	1	317	.....do.....	(2-yr-old ♀) one of a pair tried to hide under one strand of kelp after being chased and shot at.
30 May.....	1	340	Off north Oregon coast	First observed sitting upright on a log.
5 July.....	1	356	Bering Sea	Sleeping on kelp patch.
13 July.....	1	382	.....do.....	Hauled out on log.
14 July.....	2	388	.....do.....	Sleeping on kelp patch.
18 July.....	1		.....do.....	Do.
25 July.....	1	454	.....do.....	Hauled out on log.
26 July.....	1		.....do.....	Sleeping on kelp patch.
26 July.....	1		.....do.....	On kelp patch.
31 July.....	1	488	.....do.....	Do.
2 August.....	1		.....do.....	Growled before shot.
2 August.....	2		.....do.....	On kelp patch.
3 August.....	1		.....do.....	Came up to vessel and growled.
8 August.....	2	548	.....do.....	On kelp patch.
8 August.....	1		.....do.....	Growled when approached.
9 August.....	2		.....do.....	On kelp patch.
12 August.....	2	596	.....do.....	Approached vessel, one growled.
13 August.....	1		.....do.....	Growled when approached.
15 August.....	1	670	.....do.....	Do.
19 August.....	1		.....do.....	On kelp patch.
20 August.....	2	719	.....do.....	Do.
21 August.....	1	738	.....do.....	Do.
7 September.....	1		.....do.....	Do.
7 September.....	2		.....do.....	Do.
7 September.....	1		.....do.....	Near kelp patch.
8 September.....	1	865	.....do.....	On kelp patch.
8 September.....	1		.....do.....	Do.
8 September.....	1	868	.....do.....	Do.
8 September.....	1	879	.....do.....	Do.

APPENDIX C

INJURED, SICK, AND DISEASED FUR SEALS COLLECTED AT SEA

A few sick and injured animals have been observed at sea during the past 6 years.

Seals in poor physical condition may linger on the wintering grounds off California after the majority of the healthy population has departed for the summer range in the Bering Sea. Most seals that come ashore in winter are sick or injured. Observations in 1964 are summarized below.

Seal number	Date collected	Locality collection of	Remarks
US64-38	14 April	Off Cape San Martin, Calif.	Both front flippers showed bites and tears. Five open cuts on belly between fore flippers and one open cut on belly near anus. Two of the cuts were suppurating. Animal thin, with almost no fat. Gooseneck barnacles and algae on the skin.
US64-55	19 April	Farallon grounds	Skin covered with algae, guard hair missing in spots.
US64-146	2 May	.....do.....	Right rear flipper damaged and healed.
US64-148	2 May	.....do.....	(1-year-old ♂). The guard hairs on back, from neck to anus and down the sides to about dorsal insertion of fore flippers, missing.
US64-240	17 May	Eureka grounds	Cataract on right eye.
US64-273	24 May	Farallon grounds	Left rear flipper badly mangled, not healing.
US64-299	27 May	Eureka grounds	Guard hairs knotted in spots on belly and left side.

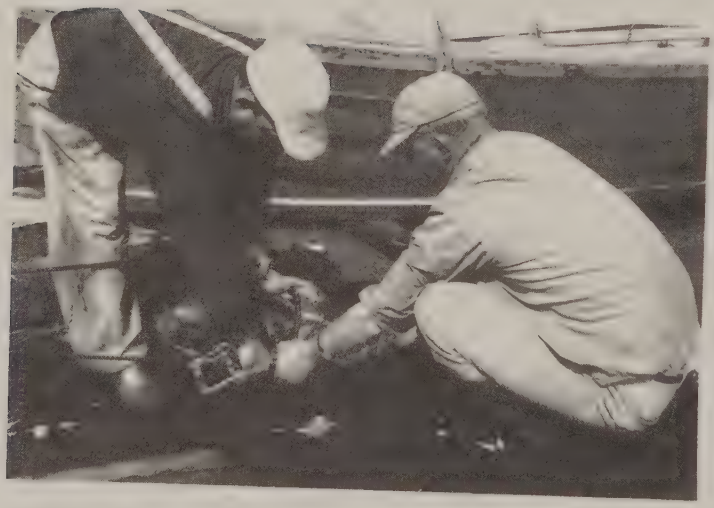
APPENDIX D

SKINNING FUR SEALS ABOARD RESEARCH VESSEL, 1964

In previous years aboard research vessels, seals were skinned by knife. This resulted in nicks and cuts which reduced the quality of skins. To improve quality, the skins were pulled from fur seal carcasses in 1964 by use of the vessel's deck winch. This technique was adapted from the stripping method used successfully on the Pribilof Islands.

To prepare the seal for stripping, it was slit open on the ventral surface from the lower jaw to the anus, the head was skinned out, and a cut was made around each flipper. A plastic tag was affixed to the skin prior to stripping (appendix fig. 9). Appendix figures 10-12 show the various steps in pulling the skin off the animal. The skins were washed and cooled by towing alongside the vessel for a short time, and stacked on deck to drain. At the end of the day, the skins were salted in the hold.

Appendix figure 9.--A plastic tag being affixed to the skin prior to pulling.



Appendix figure 10.--A noose, secured to a deck cleat, was placed around the neck of the seal and two clamps were positioned on the skin.

Appendix figure 11.--Two men watched to see that clamps remained in place and that the head was not being pulled off.

Appendix figure 12.--A skin being pulled from a seal carcass. Stripped carcasses in background.

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